MARCH 1945

Public Works

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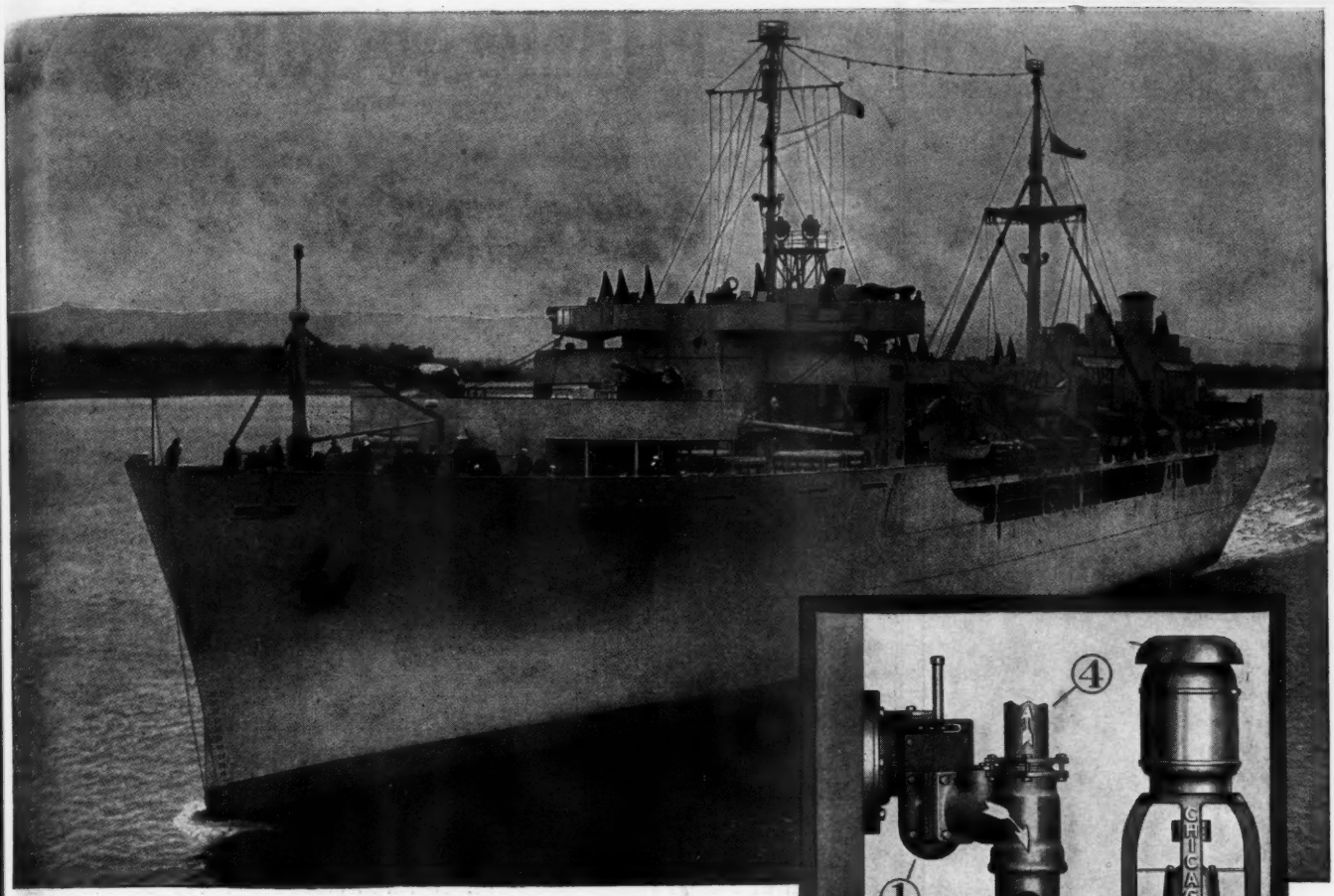


"Flush-Kleens" on U. S. Troop Transport (C-4 Type Vessel)

OVER 1,000 "FLUSH-KLEENS"

SELECTED FOR CLOG-PROOF SEWAGE PUMPING

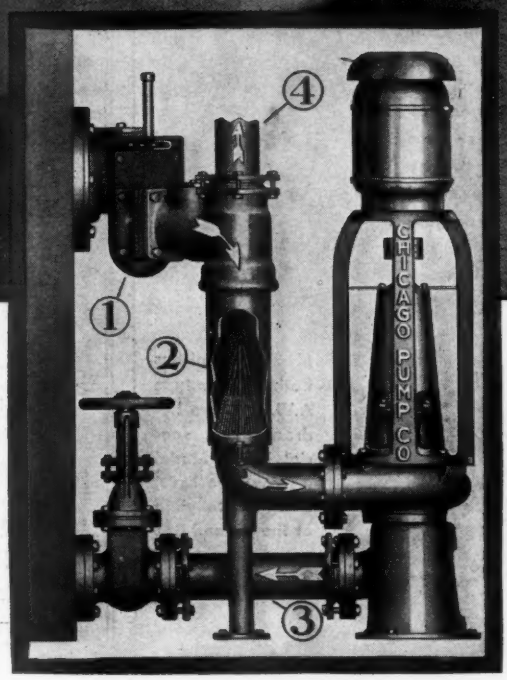
ON TROOP TRANSPORTS, AIRCRAFT CARRIERS, HOSPITAL SHIPS AND CARGO VESSELS

Recognition of "Flush-Kleens" by the Navy, Army Transportation Corps and the Maritime Commission was based on their unparalleled clog-proof sewage pumping service on the United States Liner S.S. America in 1939.

Over 3,000 "Flush-Kleens" have been installed in buildings, industrial plants, institutions and municipalities during the last twenty years.

Advantages over ordinary sewage pumps are: Cannot clog, more sanitary, no odors, less maintenance, greater efficiency and longer life, because solids do not pass through pump impellers.

Write for engineering data, application information and specifications.



"FLUSH-KLEENS" OPERATE ALTERNATELY

Sewage flows into basin through idle pump

FILLING WET WELL

① Sewage flows through inlet pipe.
② Coarse sewage matter is retained by strainer.
③ Strained sewage flows through idle pump to basin.

PUMPING

③ Strained sewage is pumped from basin.
② Coarse sewage matter is backwashed from strainer.
④ Special check valve closes; sewage and coarse matter are pumped to sewers.

Both pumps operate under peak flows.

CHICAGO PUMP COMPANY

SEWAGE EQUIPMENT DIVISION

2348 WOLFRAM STREET **CHICAGO 18, ILLINOIS**

Flush Kleen, Scru-Peller, Plunger, Horizontal and Vertical Non-Clogs, Water Seal Pumping Units, Samplers.

Swing Diffusers, Stationary Diffusers, Mechanical Aerators, Combination Aerator-Clarifiers, Comminutors.

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A. PRESCOTT FOLWELL, Editor

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WAR and POSTWAR EMERGENCIES

States Should Select Routes for the National System at Once

On March 1st Thomas H. MacDonald, Commissioner of Public Roads, announced that each State highway department should "proceed at once with a designation of routes for inclusion in the National System of Interstate Highways." The Federal Aid Highway Act of 1944 requires that these routes connect the principal metropolitan areas, cities and industrial centers of the country, and that those in each State be selected by its highway department in joint action with those of the adjoining States. Commissioner MacDonald called attention to the Interregional Highway System recommended by the National Interregional Highway Committee (see PUBLIC WORKS for February, 1944) and to the advisability of designating circumferential and distributing routes within and around the larger cities connected by the system. These are suggestions only and the PRA "intends in no way to limit the freedom of action of the States in selecting routes for tentative designation."

The Administrator of the Federal Works Agency is authorized to approve the routes proposed by the State highway departments; but the total cannot exceed 40,000 miles. It will therefore be necessary that, subsequent to these proposals, an agreement on the routes be reached between the States and the Public Roads Administration, to be submitted to the FWA.

The State highway departments are asked to submit to the PRA by July 1, maps showing the routes tentatively designated accompanied by data indicative of the merits of these routes.

Materials for Water Works

Foundry products of all sorts are hard to get because of manpower shortage, says Secretary Harry E. Jordan. Steel sheets, plate and structural items are tight again. Lumber is supercritical. Copper tubing and brass-bodied meters are available in quantities sufficient for immediate use but not for hoarding. Pig lead and lead service pipes for water works are not restricted.

If water works experience trouble in obtaining delivery of coal, alum, chlorine or other important material, they should wire Arthur E. Gorman, Director, Water Division, Office of War Utilities, Temporary Bldg. R, Washington 25, D. C., or phone his office, Republic 7500, extension 4507.

Federal Aid for Postwar Planning

A bill has passed the House appropriating $5,000,000 for loans to local governments for advance planning of postwar projects. The minimum amount to a State would be $24,000, thirteen states, the District of Columbia, Alaska and Hawaii each receiving this amount; while New York would receive $434,419, Pennsylvania $319,075, and twelve other states more than $100,000 each. The Federal Works Agency considers this appropriation inadequate and recommends that the Senate increase it to $75,000,000.

Competitive Bidding System Threatened

H. R. 2030 is "A Bill to Replace the Present Cost-plus and Other Systems of Contracting for Public Construction by a System of Negotiated Lump-sum Contracts." This is aimed by the author to eliminate "the evils that grow out of competitive bidding," which he lists as "collusive bidding, price fixing, bid peddling, chiseling, price cutting, inferior work, impeded progress, litigation, bankruptcy, economic waste, and overcharging on changes and extras and other kinds of unpardonable profiteering."

These evils he proposes to eliminate by the following scheme: contractors answer questionnaires outlining their ability to do the proposed job. These will be studied by a Construction Contract Ratifying Committee consisting of three members appointed by the President, which would have final authority over the approval of all construction contracts entered into by the government or any agency thereof. This committee would select the contractor, and the awarding authority negotiate with him to establish a lump sum fee for his services; and he, in turn must negotiate contracts with all subcontractors on a lump sum basis; all of which must be approved by the ratifying committee. Any extra work must be similarly negotiated in advance. Before final payment, the committee would audit the books of the contractors to determine the total profit; and if this exceeds the profit agreed upon, the excess is to be returned; but adjustment of losses is specifically precluded.

The American Road Builders' Association takes the position that this proposed legislation is impractical, unsound and wholly unnecesary. It will not result in lowering construction costs to the government nor will it eliminate so-called "unfair trade practices," whatever these may be. Conversely, the only possible effect of this ill-advised law will be the demoralization, if not the destruction, of an industry which, if given a chance, will play a most vital part in stimulating and maintaing a prosperous postwar economy.

Said Charles W. Smith, president of the Contractors Division of ARBA: "It cannot fail to result in favoritism and backroom or star chamber deals. It will unquestionably bankrupt the contracting industry because it requires the contractor to name a lump sum price for his services; if he exceeds this, he stands a loss; if he does not, the committee reviews his books for excess profits."

At the least, it would probably mean the refusal of contractors to bid on federal jobs and the resulting performance of these by none-contract methods.

When you need special information—consult the classified **READER'S SERVICE DEPT.**, *pages 71-73*

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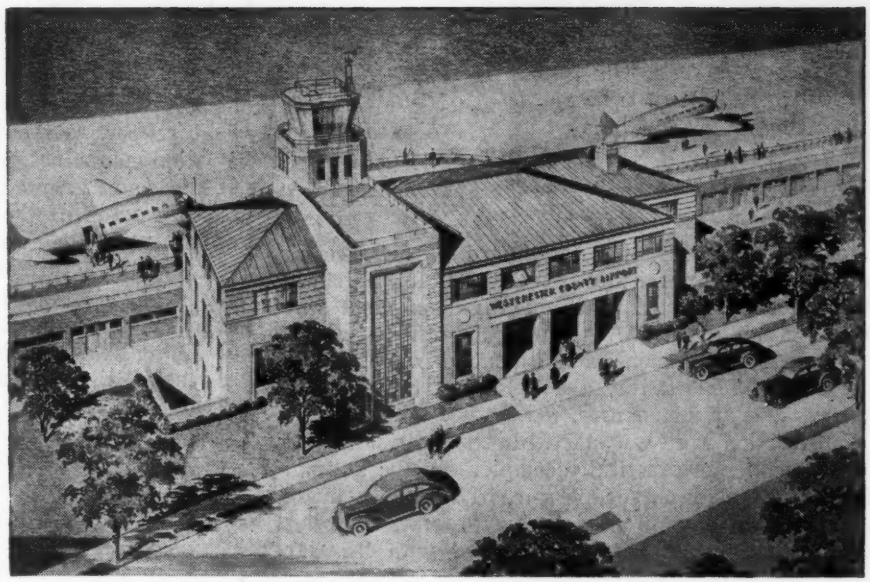


Artist's sketch of proposed Administration Building for Westchester County Airport.

Westchester County Leases Its Airport

This large airport, with runways completed in 1943, is to be operated by a private corporation, which will construct the necessary buildings and pay the county 7½ percent of the gross receipts, guaranteed to be at least $480,000.

By JAMES C. HARDING
Commissioner of Public Works, Westchester County, New York

WESTCHESTER COUNTY, located immediately north of New York City, has an area of 457 square miles and a population of 573,558. Its assessed valuation of $1,585,000,000 is exceeded by only seventeen of the states. Its 46 cities, towns and villages range in size from Yonkers, with a population of 145,000, to Poundridge, with 800. The county is residential in character and has few large industries.

The Westchester County Airport is located on the eastern boundary of the county, some four miles distant from the center of White Plains. It is 26 airline miles from Times Square, and 23 miles from LaGuardia Field. It is readily accessible to New York City and adjacent Connecticut by means of the Hutchinson and Merritt Parkways.

The airport is provided with three runways, two paved with concrete and one with black top. All runways are 150 ft. wide and their lengths are 5,000 ft., 4,750 ft., and 4,450 ft. Concrete runway pavement has a thickness of nine inches at the edge of slabs and seven in the center, and the black top runway has a six-inch base and two-inch top. Tests of the runways show their ability to take heavy planes and they have already been used by various types, including Flying Fortresses and Liberators. The airport is also equipped with 8,900 lineal feet of concrete taxi-ways 50 ft. wide, a plane parking apron, many miles of storm drains, and a system of contact lights.

In 1940 the C.A.A. offered a grant of $660,000 for the construction of a field provided we would furnish the necessary land. Due to delays on the part of the county in accepting this offer it was withdrawn the day after Pearl Harbor. Two days later, however, government officials requested that we secure a site, stating that an intercepter base in Westchester County was a necessity for the protection of New York City

Commissioner James C. Harding

from bombing raids, and the Board of Supervisors authorized the expenditure of $300,000 for purchase of the necessary land. Subsequently a contract was entered into with the C.A.A. under the terms of which the Federal Government later expended over 3.5 million dollars for grading the field and constructing runways and appurtenances.

Construction work was started in the spring of 1942 and the field was practically complete by the autumn of 1943. Limited use of the airport has been made by Army and Navy planes and by corporations doing experimental or other work connected with the war effort. The field has also been used for the training of pilots for the Army Transport Command.

Our Westchester officials expected that the airport would be turned over to the county at the close of the war complete and ready to operate with hangars, control tower and other facilities. It was, therefore, something of a shock to them when advised in the latter part of 1943 that changed conditions indicated that neither the Army nor the Navy would make any considerable use of the field and that it would be necessary for us with our own funds to complete the airport and place it in operation. Under the law, unless required by the military, the C.A.A. is not permitted to do anything more than the grading, paving, draining and lighting of the field; buildings, access roads and other needed facilities must be provided by the owner.

The contract with the C.A.A., under the terms of which the airport was built, covered a period of twenty years. We therefore had to operate the field as a public airport for the remaining eighteen years, whether or not such operation might be profitable or even desirable. A number of Westchester people believed this operation would prove burdensome. Many expressed opinions were that if the airport were not necessary for national defense it should be turned into a real estate development, a public park, a race track, or some other usage not connected with aviation. Members of our county government viewed with concern the prospect of a sizable airport being turned over to them partially complete and requiring a large appropriation for buildings, power lines, water lines and other facilities. They knew that public opinion would be against any large bond issue to complete the airport.

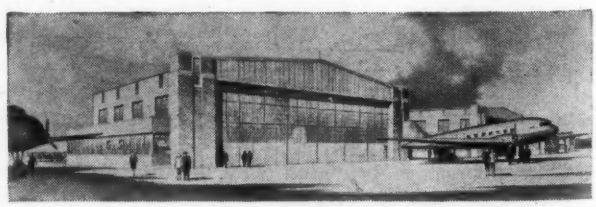
When it appeared that, like it or not, the county would have to get into the airport business, our county executive, Herbert C. Gerlach, instructed me to find out what work would have to be done by the county to place the airport in operating condition, to determine the type of flying that would be popular at the airport after the war, and to make a study as to whether the airport should be run by the county itself or privately operated under a concession.

We had no one in our employ with any considerable background in aviation, but we have designing engineers and architects experienced in the development of the county's $60,000,000 park system and the handling of a wide variety of building, recreational and highway projects, and we designated an architect and an engineer to make a special study of that part of airport design that was related to the construction of hangars, administration buildings, parking areas, lighting systems, control towers and other parts of an airport exclusive of the runways, taxiways and the field proper. We purchased textbooks, subscribed to aviation magazines, inspected airports in various parts of the country and consulted with the airport engineering staffs of the major airlines and other firms prominent in the aviation industry, and received very considerable help from the staff of the C.A.A.

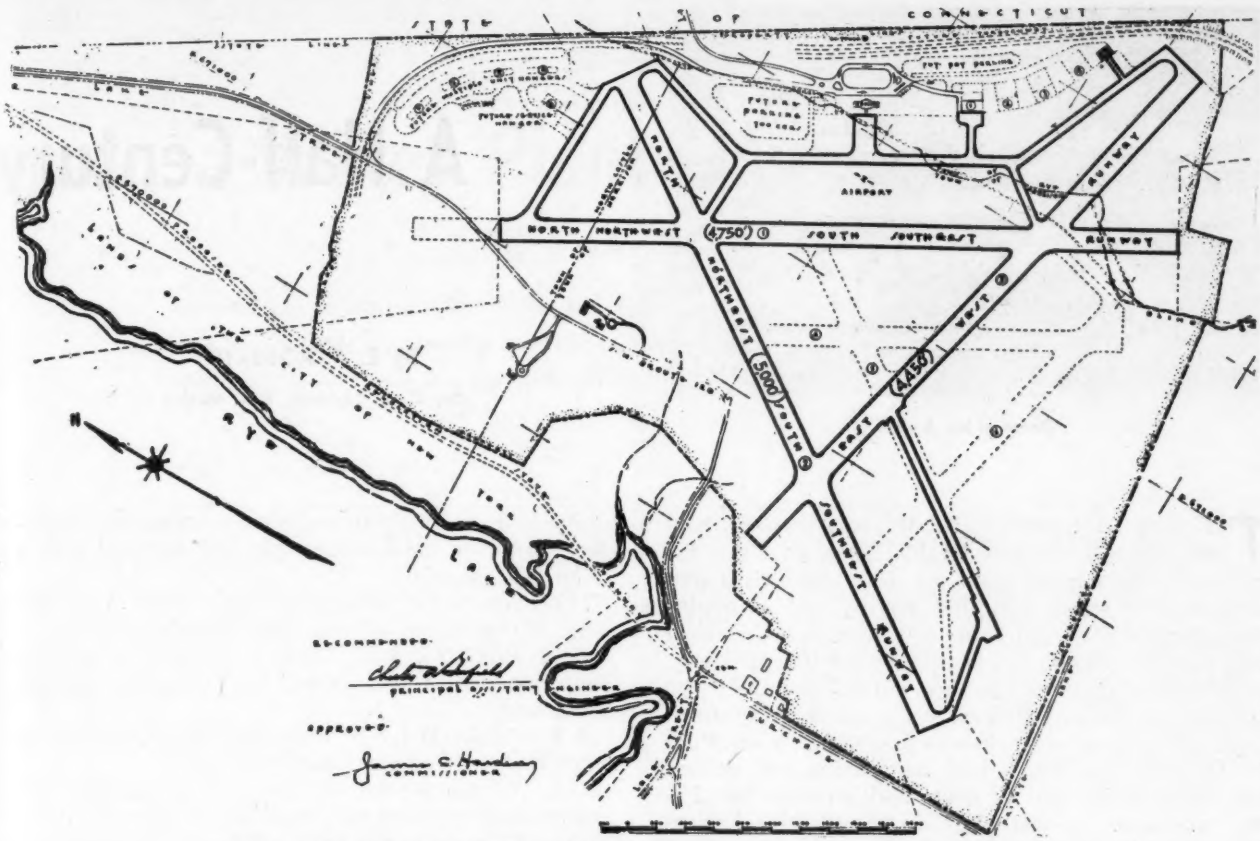
My conversations with airport managers and others experienced in the field of aviation were valuable in obtaining knowledge of existing conditions but I found a general disagreement on most phases of the future of aviation and the provisions that should be made now for handling its many ramifications. One early-appearing complication, particularly vexing at our airport, was that whereas we knew we would get a large volume of private flying and believed we would have a certain amount of scheduled airline operation, we were not sure what the ratio would be. Consequently we were at a loss to know what services to provide for the private flier as compared with those for the commercial operator.

We obtained from the New York State Postwar Planning Commission an appropriation of $6,000 for aid in designing the layout of the hangar area and the various buildings, and the county matched the State funds. Our own engineers, with help from the C.A.A. and airline experts, proceeded with the work of laying out the hangar area and of designing the water lines, sewers, power lines, access roads and other needed facilities. Subsequently we employed the firm of Alexander D. Crosett and Associates, of New York City, to design an administration building and a standard hangar. These and our own designs were submitted to the C.A.A. and revised in the light of their criticisms, and we were then in a position to know about what the county faced in the way of expenditures for the completion of the airport.

There existed a rather strong feeling in the county that the operation of the airport was a commercial venture and therefore belonged in the field of private enterprise rather than governmental. Our officials felt that employment of an experienced airport manager would not entirely counterbalance their own lack of knowledge of the aviation business. They were also aware of the handicaps inherent in municipal operation of a new project of this type, including the necessity for strict observances of civil service requirements, budgetary controls, the difficulty in securing appro-



Artist's sketch of proposed hangar.



Map of Westchester County Airport, showing existing runways and proposed additions.

priations, etc. Inquiry revealed that few municipal airports were self-supporting as far as even meeting operating expenses, and that practically none were self-liquidating as far as meeting capital obligations.

We found that there were a large number of privately owned airports, but they were mostly small and required a limited capital outlay; whereas, to complete our airport and place it in position to operate as a Class 4 modern airport would necessitate the expenditure of at least $1,000,000. A few municipalities had granted concessions to one firm for the operation of their entire airports, but generally the buildings had been constructed by the municipalities and the municipalities themselves looked after much of the maintenance. We were doubtful that any operator would invest the required funds but decided that the best way to get a definite indication of the possibilities of private operation would be to take bids.

After considerable difficulty due to lack of precedent and our own ignorance of the subject, we prepared specifications and advertised for bids. We had plenty of interest of an academic nature but no crowding of our doorsteps with potential bidders. Operators of flying schools told us we wanted too much in the way of new construction. Airlines told us they were not interested. One firm that wanted the job of managing the field commented as follows:

On Monday of this week we received a copy of Proposal and Specifications for Westchester County Airport. Our Engineers and Legal staff have read it with great interest and nominate it for the Hall of Fame as the most impractical and impossible Proposal we have ever had the pleasure of reading. On the basis proposed by Westchester County we doubt very much whether any sane business firm or group of business men would go along with it.

Despite a real campaign to secure bids we were dubious up to the last minute as to our prospects. Much to our surprise we received four bids and their terms exceeded our most optimistic expectations. A comparison of these bids follows:

Comparison of Bids Received

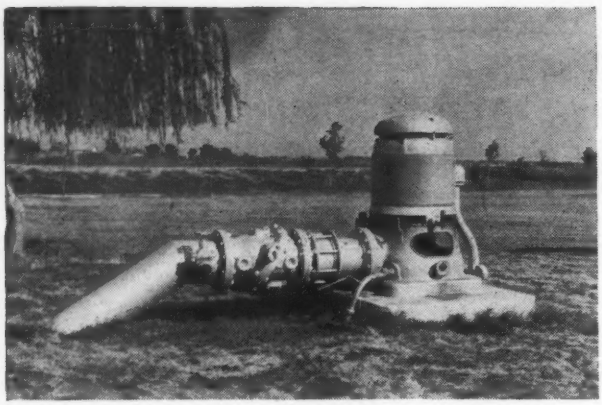
Item (Over Life of Contract)	*Henry W. Mallinckrodt (Backed by Shell Oil Co.)*	*John A. Gillies, Jr. (Backed by Texas Co.)*	*North American Airport Corp. (Backed by Gulf Oil Corp.)*	*Socony-Vacuum Oil Co., Inc.*
Minimum Guarantee	$221,000	$317,500	$480,000	$264,000
Percentage of gross	10%	7½%	7½%	4.03%
Gross income (Bidders own estimate)	5,210,868	6,454,250	11,930,540	12,719,765
County share of gross income	521,087	380,600	899,050	539,998

All the bidders agreed on only one thing—that their particular bid was the best for the county; and they also managed to get a few of the County Fathers thinking that same way. After several weeks of conferences we awarded the concession agreement to the North American Airport Corporation.

The term of the contract is for fifteen years after flying conditions return to normal. This period was longer than we had wished but was necessary in order to afford the concessionaire a chance to get his investment back.

The county is to fence the property, do the rough grading for the hangar area, construct certain storm sewers, power lines, water lines, sewers, parking area, a sewage treatment plant and an access road. The estimated cost of these improvements is $400,000.

(Continued on page 42)



Pump at No. 6 well.

A Half-Century Rec

By E. A. ROBERTS

City Clerk, Carlsbad, New Mexico

THE City of Carlsbad, N. M., was started about 1890, when it was called Eddy. Soon after that the railroad built a water plant for their locomotives consisting of a steam pumping engine and standpipe about 3 miles from the town. A 6″ main was laid from this to the business district to provide it with water, but the largest part of the town had water delivered to it by a horse-drawn tank wagon at 25 cents a barrel.

In 1908 this waterworks was purchased by the Public Utilities Co., which laid new mains and drilled two wells a mile west of town, and installed two 2½ in. two-stage, vertical Worthington turbine pumps driven by single-phase 220-volt Wagner motors, and erected a 16 x 70-ft. standpipe constructed by the Chattanooga Iron Works. A single-stage 4″ Worthington turbine pump belted to a 30 hp single-phase 220-volt Wagner motor, was installed as a booster pump which was put into service in case of fire.

Now, in 1944, none of these pumps is in service, but we have drilled six more wells (two abandoned later) and are operating four Peerless pumps at the new wells, two 8″ and two 10″, and four booster pumps, a 6″ and a 5″ Worthington, and a 6″ and 4″ Fairbanks Morse. The four main pumps have a combined capacity of 4,750 gpm. The consumption last summer reached a maximum of 4 mgd.

The system of mains has increased from three miles of 6″ pipe to 15.63 miles of 12″ to 4″ and several miles of 2″, with 71 fire hydrants and more than 2,000 meters. All pipe laid at this time was cast at the Texas State Prison Foundry.

This increase was not made all at once, but at intervals of several years advantage was taken of the necessity for meeting increasing consumption to bring the plant up to date.

1908. The single-phase motors of the 1908 equipment were beautifully built machines but today would be curiosities. In order to reduce the starting load, each motor was equipped with a water rheostat consisting of a barrel of salt water and a rope-operated electrode. The rheostat was short circuited by a knife switch when the motor came up to speed. An operator at 6 o'clock in the morning filled the standpipe. Then he phoned the office and the circuit breaker on the 2,400-volt line to the wells was opened. Then he closed the switches on the booster pump so that it could be started from town in case of fire, and his duties for the day were over. (Later an operator was on duty at all times.)

1915. This year the single-phase motors and old pumps were replaced with 20 hp 3-phase motors and 3″ American centrifugal pumps, each of 300 gpm capacity and much greater efficiency. Also the single-phase motor on the booster pump was replaced with a 40 hp 3-phase motor.

1923. A new well was drilled and the 3″ American pump on one of the old wells was transferred to it.

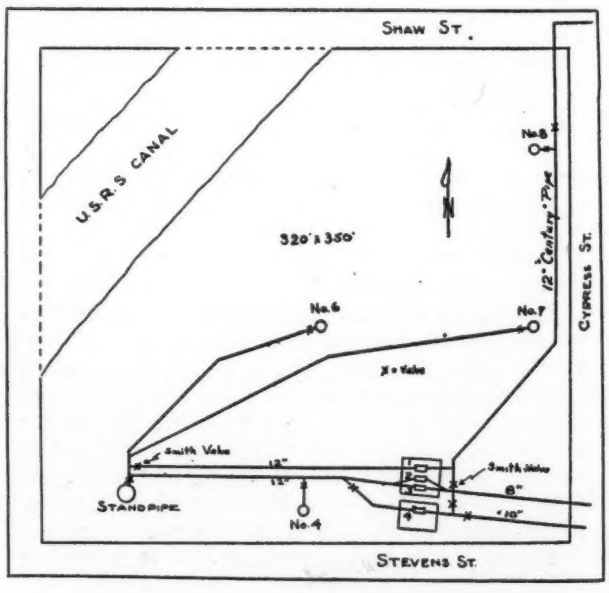
1928. Well No. 3 was drilled and a Price turbine pump installed in it. This well later caved in and was abandoned.

A Fairbanks Morse 6″ centrifugal pump and 30 hp motor replaced the old booster pump.

1933. To provide for increased consumption, a 10″ cement-lined cast-iron main was laid to supplement the original 8″ main to the town. (All cast-iron pipe laid since 1928 has been cement-lined.) A 150,000 gal. elevated tank with an overall height of 150 ft. was installed downtown by the Pittsburgh-Des Moines Steel Co. As this tower is 50 ft. higher than the standpipe, it became necessary to re-pump all the water. All pumps are equipped with Chapman non-slam check valves and the well pumps have Sparling main line meters on the discharge, and Crispin air valves to remove entrapped air.

The booster pump was paralleled by a new 5″ Worthington rated at 900 gpm at 139 ft. head, direct connected to a 50 hp GE motor. At this time, 12″, 10″ and 8″ mains were laid to connect the elevated tank to the four principal 6″ distribution mains.

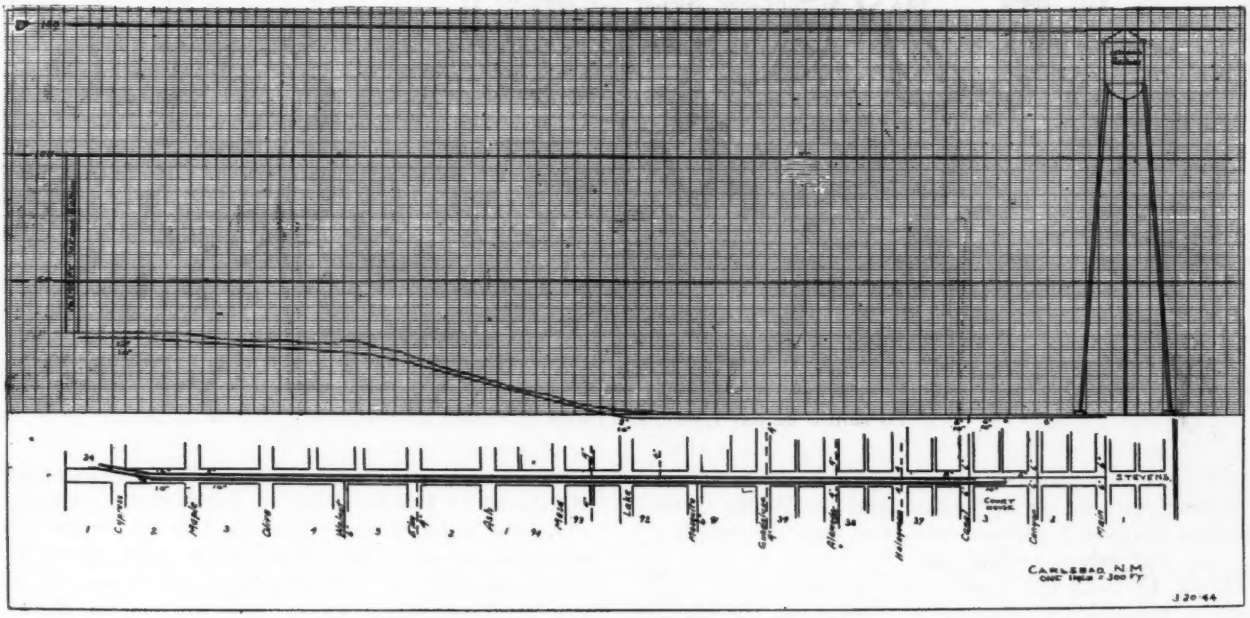
1941. The city bought the plant from the Public



Location of wells, pumps, valves and standpipe.

eeping a Water Plant Up-to-Date

Beginning with service furnished from a railroad tank, followed by purchase by a private company and then by the city, Carlsbad's modern plant now can pump 4,750 gpm into 20 miles of mains.



Profile of pipe line connecting tank and standpipe.

Service Company and engaged the National Water-main Cleaning Co. to clean all the mains, which greatly increased the carrying capacity. But the town had grown to some 15,000 population and supply capacity needed increasing also and plans were made in the spring of 1944 to run a new 12″ line from the water plant to the north part of town. It was impossible to secure cast-iron pipe and 5,400 ft. of 12″ "Century" asbestos-cement pipe, 5,270 ft. of 6″ and 1,640 ft. of 4″, was obtained and laying of it has recently been completed. Half of the trench was in rock and $800 worth of dynamite was used in excavating it, which was included in the contract price of $1.00 per foot for ditching and laying the pipe and setting 14 valves and 4 fire hydrants. The ditching was done with an Austin ditcher and a ½-yard Bucyrus-Erie hoe; and using these in earth, the contractor made good money in opening and backfilling at 20 cts. a foot.

Booster pump house.

The question naturally arises as to why a 12″ pipe was run to town and then connected to two 6″ lines, but the answer is that it is planned to build tie lines across town. Also the 12″ line supplies a large amount of water to customers along the route, including two new FHA housing projects having nearly 100 homes now built.

With this increase in main capacity, the pressure at the pumping station has fallen from 75-80 lb. to 50-60 lb. To increase the pumping capacity, there was purchased a 6″ Worthington horizontal, single-stage, volute centrifugal pump rated at 2,000 gpm at 150 ft. head, direct connected to a 100 hp 2,200 volt Westing-house motor.

In installing the new, 2,000 gallon Worthington pump, it was necessary to make two 12″ connections to existing cast-iron mains, one on the low pressure side and the other on the discharge main. Two 12″ tapping sleeves were purchased from the A. P. Smith Mfg. Co. and the same company furnished a machine and an operator to make the installations. This was done under full pressure and without the loss of any water. The work could have been done by shutting off the water,

The earliest delivery system, at a charge of 25 cents a barrel.

but it was considered worth the extra cost to maintain constant pressure on the mains, and the Water Commission was very pleased with the way the tapping sleeves and valves worked out.

1944. In 1942 and 1944 three 12″ wells, Nos. 6, 7 and 8, were drilled. Since No. 5 was on the high-pressure line and had a much greater lift than the other wells it was abandoned and its pump, provided with a new pump bowl assembly, was installed in well No. 8. This pumps directly into the system against a 200 ft. head without passing through the booster pumps, using a 75 hp, 2,300-volt motor.

The operating plan or scheme for the waterworks is briefly this: Water from wells Nos. 4, 6 and 7 is pumped into the 12″ pipes connected to the standpipe. As many pumps are operated as is necessary to keep the standpipe reasonably full. No. 4 pump is connected through an altitude gauge and operates automatically when the water level in the standpipe drops to about 48 feet and shuts down automatically when the level reaches 69 feet. In this way the other pumps can be left running longer without attention as they are all manually controlled. Water from the standpipe (or direct from the wells if the standpipe is discharging) goes to a header and thence through one or more booster pumps and into the three lines leading to town and through the distribution mains to the elevated storage tank. Well No. 8 has enough pressure to pump into the 12″ line going to town. The suction pressure on the booster pumps averages about 28 pounds. It can be raised by shutting off the standpipe and using enough pumping capacity to furnish more water than the boosters will handle. The pumps then fall off in capacity but their head goes up. The pressure on the discharge lines from the boosters will vary between 50 and 75 pounds. With no pumps running, it will stand at 40 pounds if the tank in town is full, there being a difference of ground elevation between the pumping station and town of thirty feet For this reason the 70-foot standpipe on a 30-foot elevation lacks almost 50 feet of reaching the 150-foot elevation of the top of the water tower. Consequently it is necessary to pump all the water that is delivered to town against a pressure difference between the 28 or 30 pounds furnished the boosters by the standpipe and the 60 pounds head on the elevated tank plus friction head and less the thirty-foot ground level difference

Since the downtown elevated tank was too far from the pump station to allow the operator to see the target indicating the water level, a Bristol Telemeter System was installed, with a transmitter on the elevated tank and a recording chart in the booster house at the well. With this the operator has a constant indication of the

(Continued on page 50)

No. 4 well, showing Chapman non-slam check valve and Sparling meter.

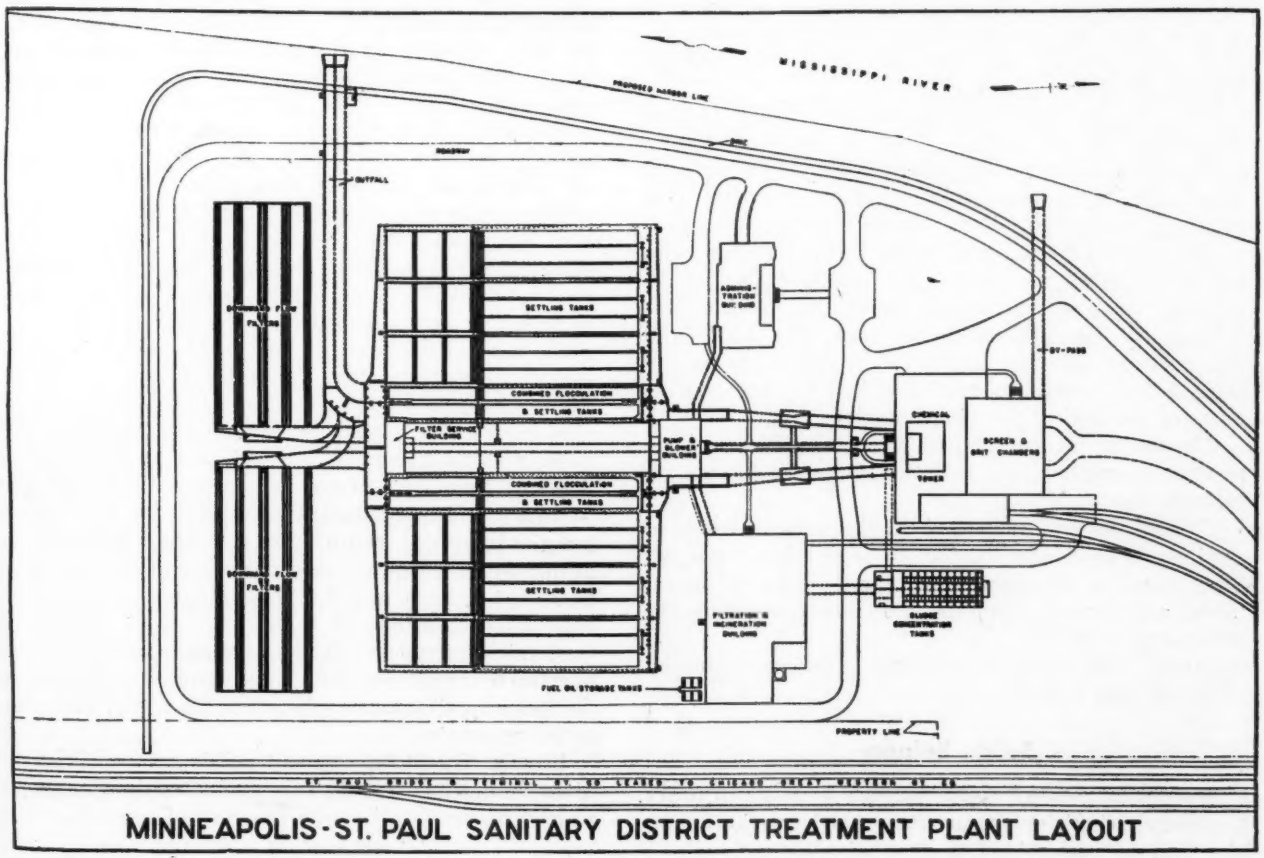
Making a Solids Balance at a Sewage Plant

Methods of sampling screenings, sewage, sludge, supernatant, filter cake, sludge effluent and plant effluent at the Minneapolis-St. Paul plant, and of calculating the solids balance therefrom.

THEORETICALLY it should be possible to determine the total solids reaching a sewage treatment plant during a given time by determining the solids content of each of a number of samples of the sewage as it enters the plant and the rate of flow at the time of each analysis; and to determine in the same way the total solids leaving the plant. And the difference between these two should equal the solids removed by the plant as sludge, screenings, etc., and thus a check be obtained on the several analyses. In practice, this is far from being easy or even possible. The determination of the solids in the sludge can be made with fair accuracy, by weighing the total dried sludge for a month or year and determining its moisture content. Least in reliability is the determination of solids in the sewage as it enters the plant, for this is constantly changing minute by minute, both in content per unit volume and in volume of flow; moreover, the suspended solids are not uniformly distributed and any sample is apt to contain either a concentration of floating solids or practically none of these. Much greater accuracy in determination of the solids leaving the plant is possible because, during the treatment, the inequalities of content have been smoothed out and the rate of flow is more uniform.

For these reasons a solids balance is difficult to make with reasonable accuracy, and "reasonable" would appear necessarily to involve pretty wide latitude—even a 25% difference between calculated input and discharge would seem to be reasonable, even if the most exact methods customarily employed in laboratory analyses and the operation of treatment plants be relied on.

An interesting description of the methods and results of the solids balance made by the plant of the Minneapolis-St. Paul Sanitary District is contained in the report for the year 1943, from which the following description has been taken, including the unusually careful method of taking the samples from which the balance was computed.



MINNEAPOLIS-ST. PAUL SANITARY DISTRICT TREATMENT PLANT LAYOUT

The chief engineer and superintendent of the Sanitary District is George J. Schroepfer. Benjamin M. Storey, William M. Trulander, Van H. Parker and Glenn Stroessenreuther were the plant operators.

Sampling Methods

The screenings and grit removed from the sewage in the screen and grit chamber building were sampled daily, with 24-hour composite samples made up from grabs off the conveyor belts. The grab samples were placed in pails with perforated bottoms to permit drainage of any excess water, after which the unit weight per cubic foot was determined. The daily quantities in cubic feet were computed from the number and estimated size of truckloads hauled to the dump. The moisture and volatile matter contents were determined in the laboratory.

Samples of the sewage from the various plant units consisted of daily 24-hour composite samples collected by automatic machine samplers, which proportion the sample to the rate of sewage flow. Once a shift, the one-gallon aluminum sample cans are removed from the automatic samplers and placed in a refrigerator. The pipe lines to the automatic samplers are backwashed once a shift with plant effluent under pressure. Once a week the sampler parts are brushed and washed with copper sulfate solution and the raw sewage sampler lines are blown back with compressed air. The samplers are checked periodically for proper proportioning and mechanical operation.

The raw sludge samples were daily 24-hour composites of grabs from sampling cocks on the sludge pumps. From each pump operating, a sample is taken fifteen minutes after starting, every fifteen minutes during the pumping, and once when the pump is stopped; allowing the sludge to flush through the sampling pipe before collection of each sample.

The supernatant liquor pumped back to the raw sewage from the sludge concentration tanks was sampled by collecting two 100 ml. ladles every fifteen minutes during pumping.

The concentrated sludge samples were daily 24-hour composites of the sludge going to the conditioning tanks, obtained by taking two 100 ml. ladles per hour from a bucket of each bucket elevator operating. One to two gallons of composite sample were thus obtained.

The filter cake samples were daily 24-hour composites collected by applying a cookie cutter to the discharge side of the vacuum filters. One "cookie" was collected per filter operating per hour. The sludge and filter cake samples are deposited in milk cans having tight fitting covers to minimize loss of moisture by evaporation during the sampling day.

The sludge filtrate samples were daily 24-hour composites of hourly grabs collected from the filtrate receivers.

Toward the end of each shift, the samples collected during each 8-hour period of operation were all brought to the laboratory and placed in the refrigerator to await compositing by the chemist on duty the following morning.

Samples for dissolved oxygen were grab samples collected once a week.

Solids Balance

A monthly over-all solids balance is made in order to obtain a check on the accuracy of the various samples and measurements of quantities throughout the plant. The daily removal of solids by the plant is first computed from the laboratory analyses of the incoming and outgoing sewage together with the sewage volume as measured by the venturi meters. This is called the "computed removal"; i.e., it represents what should be in the bottom of the settling tanks as sludge. Two different laboratory determinations, total and suspended solids, gave computed removals in fair agreement through the year, with discrepancies averaging 2.5% and ranging from 0.3% to 5.3%.

The next step in the solids balance is to determine the quantity of solids actually removed from the settling tanks and handled as sludge. At this plant there are three different ways in which this "actual removal" can be evaluated, each involving different samples and quantity measurements: (1) from the per cent solids in the raw sludge and the quantity of raw sludge pumped as measured by the sludge venturi meters and checked roughly against pump capacity; (2) from the per cent solids in the concentrated sludge and the quantity as measured by the bucket elevators; (3) from the per cent solids in the filter cake and the quantity as weighed by the continuous conveyor belt scales. These quantities are gross removals. They are then corrected for the solids returned to the sewage in the form of supernatant from the concentration tanks and filtrate from the sludge vacuum filters, and for the portion of the sludge conditioning chemicals remaining in the filter cake. The 1943 actual removals as figured on these three different bases agreed quite well, the maximum variation from their average ranging from 0.6% to 16.5% and averaging 10.7%.

The next step in the solids balance consists of comparing the "actual removals" with the "computed removals." The discrepancy between the computed removals and the actual removals averaged 9.9% for 1943, ranging from 2.4% to 20.4%. This figure of 9.9% represents the straight average of the individual monthly discrepancies. If the average discrepancy for the year is based on the total tons of computed and actual removals for the entire year—30,094 and 32,955 tons, respectively—some of the individual monthly discrepancies (partly due to variations in sludge inventory or carry-over) are ironed out, and the average discrepancy for 1943 then becomes 8.7%.

The raw sewage samples for the months of February, March and May were apparently too weak, considering the comparison between the tons computed removal and the tons actual removal during these months. As exceptionally heavy thaws and rainy periods were experienced during these months, it seems logical to conclude that all of the heavy street-wash solids which entered the settling tanks were not sampled representatively at the raw sewage samplers. The same reasoning can be applied to occasional heavy doses of lime solids from the Saint Paul Water Department softening plant. Clogging of the raw sewage sampler inlet pipe, resulting in screening of the sewage at this point, which was originally one of the sources of trouble, has been practically eliminated through routine shift cleaning of these inlet lines. Similarly, mechanical troubles with the automatic samplers have now been ironed out with a consequent reduction in the per cent discrepancy between the actual and computed removals.

Finally the "total over-all solids removal" in the plant is determined. This is evaluated in two ways: (1) by computing the total dry tons of screenings and

(Continued on page 32)

Carrying a Water Main Across a Ravine

Wooden trestle, destroyed by flood-carried boulders, replaced with a steel tower made of well casing and gas pipe from stock, welded together by the plant operator.

By R. H. SNYDER
Manager, Clarion Water Co., Clarion, Pa.

THE Clarion Water Company, supplying Clarion, Pa., takes its supply from twelve deep wells along the bank of the Clarion river, which itself is too badly polluted by pulp mill and tannery waste to afford a supply. After treatment by aeration, mechanical mixing, sedimentation, filtration and chlorination, the water is pumped through 4000 feet of 10″ steel transmission main to the standpipe, the elevation of which is 500 feet higher than the pumping station.

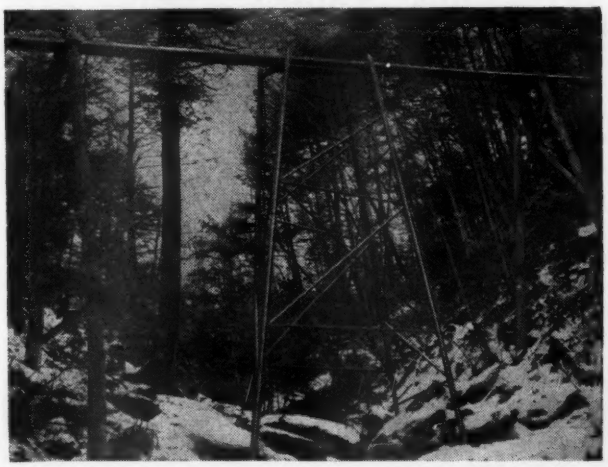
The transmission main traverses a dense hemlock forest for its first 2000 feet, and at a sharply rising grade. Five hundred feet beyond the pumping station the main crosses a very sharp, boulder-strewn ravine. At this obstruction a wooden trestle, comprising seven A-frames with light inter-bracing, supported the main for a span of 140 feet, at a maximum elevation of 40 feet above the bed of the small stream which flows down the ravine.

After a flash flood which followed a cloudburst, the two main bents of the trestle were knocked away by the 100-pound boulders which were carried down the stream. The steel main, though sagging slightly, was undamaged, and indications were that it would remain suspended safely across the 54-ft. span until additional support could be provided. As a precaution, however, we inspected the trestle daily and drained the transmission main every night.

The most obvious solution to the problem was to replace the A-frame bents that had been knocked out. This, however, had several disadvantages. First, that would leave the position just as vulnerable as it had been in the past. Secondly, the terrain was so rugged that it would be very difficult and costly to do the work; a contractor asked $610 for labor alone. Finally, the remaining bents might deteriorate in time, and it was desirable to provide a structure which would support the entire main, if necessary.

With these conditions in mind, we finally decided on the tower shown in the accompanying photograph. Using 5″ steel well casing and 2″ gas pipe, both of which had lain idle in our inventory for years, we designed the tower and began construction. First we located the four footings for the tower, so spaced and located as to provide a minimum of resistance to future flood debris, and excavated one foot into bedrock for each leg. A portable gasoline hammer was used for the excavation.

Nine 24-foot sections of well casing and about 200 feet of gas pipe were carried up the transmission main right-of-way to the near bank of the ravine. Here eight of the well casing sections were coupled together into four legs and each placed with one end in a foundation hole. Then, by means of rope-blocks from two directions, the 48-foot sections were hoisted into position against the main. Wooden spreaders held the upper ends in their proper positions, ten feet apart longitudinally and six inches away from the main.



Gully crossing. Bents of the old timber trestle are shown at the right and left of the steel tower.

From here on it was a straightforward welding job. The chief plant operator, who had had some experience at acetylene welding, did the job very skillfully with a reconditioned outfit which we bought for the purpose. After working from the bottom to the top with the cross-bracing, using the 2″ gas pipe, he finally connected the tops of the posts in pairs by pieces of 5″ well casing set horizontal at right angles to the transmission main and welded in place. To support the load uniformly over the ten-foot longitudinal distance, a cradle was formed from two pieces of 5″ well casing, welded to the two short cross members close to the main, which cradle was raised just enough by jacking to remove the sag from the main.

As final steps, the tops of the leg supports were cut off and pointed, and 3′ x 3′ x 3′ concrete footings were poured into the foundation holes. The entire structure, including the transmission main, was painted with two coats of General Paint Corporation's Biturine Akwakote.

Thus a difficult replacement job was done with very little critical material, almost no extra labor, and at a cost of about $700, including the welding outfit, which continues to give us service.

Removing Unused Rails from the Streets

Methods and equipment employed in removing more than twenty thousand tons of abandoned street railway track in these two cities and restoring the pavement.

Removing 26,000 Tons of Rails from Seattle's Streets

By C. L. WARTELLE
City Engineer, Seattle, Wash.

TROLLEY coaches supplanted street railway transportation in Seattle, Washington, in April 1940, leaving approximately 27,500 long tons of steel rails in 100 miles of streets. About 9,000 long tons were in unpaved center strips 18 ft. wide between paved roadways. These rails were removed by the Transit System in 1940 and early 1941, and the 18 ft. strips were surfaced with 2" of asphaltic concrete on a gravel base.

Pulling rails with a Koehring shovel.

This surface, confined between paved roadways, has given good service.

The remaining 18,500 tons of steel was embedded in permanent pavement. Of this, about 1,500 tons has been left in the streets, 500 tons in monolithic pavement and 1,000 tons in sound pavement which had been covered with a 2" asphaltic resurfacing in 1940 and 1941 prior to the scrap shortage.

Approximately 4,000 tons was removed in 1941 and 1942 by the city under contract. In removing these rails the 18 ft. street railway sections were stripped to the base, which was then built up to the original street surface elevation, and the entire width of the roadway was surfaced with 2" of asphaltic concrete. The removal of this steel and the rehabilitation of the streets cost about $360,000, or $90 per ton of steel removed.

The remaining 13,000 tons were removed in 1943 and 1944 under an agreement between the city and War Materials, Inc., a government agency whereby 3,000 tons were removed by the city and 10,000 tons by the Government. The city took the streets with concrete side roadways and brick paved street railway sections 18 feet wide which were paved with concrete. The Government took the streets with brick, stone and asphalt pavements, and in general removed the rails by opening a two foot trench for each rail and restoring the surface to the level of the adjacent pavement.

The Government paid the city $46.50 per long ton for the steel removed by the city and restored the pavement as consideration for the steel recovered by the concrete paving 18 feet wide averaged $100 per ton of steel recovered. The Government sold all the steel to local mills for $16.50 per ton.

The city, through a supplemental agreement with the Government's contractors, took over the repairs on 6½ miles of arterial and business streets which were paved with brick in poor condition, and combined these repairs with complete resurfacing.

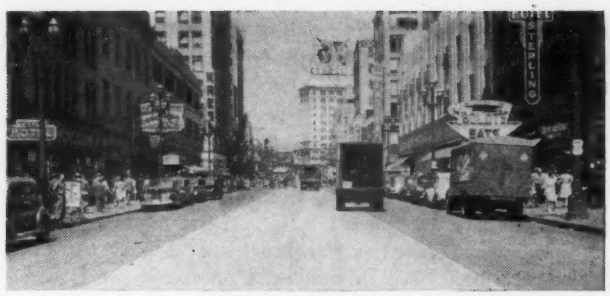
All the rail pulling and the removal of brick and stone surfacing was done with mechanical equipment, and the ties were left in place. Two types of mechanical rail pulling equipment were used. One, a "Unit ½ Yard Shovel," carrying an A frame, lifting the rails by means of two 3-sheave pulleys and a pair of tongs. The second type of equipment was a Koehring 2 yard shovel, which lifted the rails by raising the boom. (These rigs are shown in the accompanying photographs.)

Occasionally, where the street railway pavement was well grouted brick, it was necessary to loosen one line of brick along the outer rail before pulling.

The Government's work was done under contract

Pulling rails with a "Unit half-yard shovel."

ts Seattle and Mobile



View of street after completion of paving.

by the Northwest Construction Company, and the city's work under contract with Northwest Construction Company, Toney Romano, and Argentieri & Colarossi, all of Seattle.

The streets from which the Government removed rails were not completely resurfaced and this work is being done by our maintenance forces as part of the city's regular maintenance operations, under which approximately 25 miles of streets are resurfaced annually.

The effect of this rehabilitation program on the carrying capacity of the streets is very evident. As an example, the roadways on many of our downtown thoroughfares are 54 feet in width. Allowing 7 feet adjacent to each curb for parking, the remaining 40 feet of roadway should provide for four moving lanes, but prior to the removal of the rails motorists invariably straddled the outer rails, resulting in waste space and only two lanes of moving traffic. These roadways now carry four lanes during the major portion of the day, and during the morning and evening hours of maximum traffic are cleared of all parking, providing six lanes.

Furthermore, the traffic can move steadily forward controlled by synchronized traffic lights, whereas in the days of the street cars the entire traffic stream was halted at each intersection to permit the loading and unloading of passengers.

Removing More Than 53 Miles of Rails from Mobile's Streets

By HARRY L. FISHER
City Engineer, Mobile, Alabama

IN 1942, the rails of the Street Railway Company tracks, totaling more than 53 miles, were removed from the streets of the City of Mobile, Alabama, in order to salvage the rails and all metal appurtenances for the furthering of the war effort.

Seattle street after removal of rails.

The title to the street railway tracks in the city was transferred from the Mobile Light & Railroad Company to the City of Mobile, which in turn transferred said title to the Metal Reserve Company, a subsidiary of the Reconstruction Finance Corporation, and permission was given to them to remove the rails from the streets, providing certain specifications for the repair of the streets, as approved by the City Engineer, were adhered to.

Seattle street during paving operations.

The Metal Reserve Company let the contract to M. E. Lipsett. His equipment consisted of many air compressors and an A-frame mounted upon I-beam runners spaced about twelve inches apart. The A-frame supported a multi-cabled block which was powered from a winch of one of our local towing company trucks, which also supplied the motive power for moving the A-frame.

First, a trench approximately six inches wide on the outer side of the rail was cut to a true chalk line and to the depth of the pavement, and all of the material removed well in advance of the rail removing machine. Then all of the tie-rods, which were spaced five feet apart, were freed from the rail by shearing them by a sharp blow from a sledge hammer on the outer nut that secured it to the rail. Then the rail removing machine straddled the rail to be pulled and a pair of tongs was lowered and attached to the ball and the base of the rail and the first pull was made, giving an outer and upward lift to the rail. Just as soon as this first pull had been made, the tongs were released and a better bite secured on the rail and the upward and outward pull again was resumed until the rail was pulled up between the two aforementioned I-beams and entirely free from the pavement. This was repeated about every four feet.

The harder the rail was to pull, the harder became the pressure on the pavement under the I-beams; thus

eliminating large fractures in the pavement, as the pavement break was all confined to the space between the I-beams.

All of our rails in the city were welded together into one continuous rail, and after a rail had been removed from the pavement it was burned through the ball at points about twenty-five feet apart, and then picked up by the machine and dropped on a piece of wood, thus fracturing the rail all the way through. These sections were then loaded on trucks and transmitted to cars and shipped to their destinations. Occasionally, where the pavements were not in such a condition that the I-beam contacted the pavement under all points of the beam, a slight disruption of the pavement occurred outside of the beams and the tie would sometimes be slightly lifted from its bed.

As soon as the rails had been removed from the line of work along the street for a sufficient distance to permit continuous operation of replacing the pavement, that work was started. An inspection was made of the pavement and all loose material was removed and the excavated trench thoroughly cleaned and swept; and if any portion of the pavement was fractured beyond the line of trench it also was removed and the trench line was straightened and concrete was then poured in the trench; using a 1:2:3 mix with a water-cement of ratio of six gallons of water to one bag of cement.

Where it was a one-course concrete or brick surface, the concrete was poured to the top of the trench and finished as of any other type of concrete pavement. High early strength concrete was used in most of the work in order to permit removing the barricades as soon as practicable. Where asphaltic surface was encountered, the concrete base was poured to within one and one-half inches of the surface, and as soon as this had set sufficiently, a cold-mix asphaltic concrete material was placed thereon and thoroughly rolled with a portable gasoline roller. The type of asphaltic material used was all of the wearing surface type, as it was found too difficult to place this material and thoroughly compact it in two courses.

City inspectors, working under the direction of the City Engineer's office, were continuously on the job to see that all of the specifications were complied with and to assist the contractor in whatever way that they could to secure a good job. Traffic was never completely barred from using the street where we were working, and with the cooperation of the contractor we were able to plan the work so that the general public was very little inconvenienced.

The work was completed about two years ago and the repaired portions of the street, with very few exceptions, are in perfect condition. However, wherever the deep paving rail sections had been used, there is some evidence of a few ties having been disturbed during the rail removal operation and in settling back into place by the pounding of traffic, the pavement has cracked at these points.

However, we have miles of streets that show no defect whatever. On some of the main travelled streets we have resurfaced with cold mix asphaltic concrete, from curb to curb, since the rails were removed and secured a better crown in that space occupied by the street railway tracks and one would never know that the streets ever had tracks in them. I believe we secured as good a job as it was possible to get.

A total of 282,740 lineal feet of rail was removed, which totaled approximately eight million pounds.

Observations on Bio-Filter Loadings

IN a recent personal communication, Harry Eichenauer, operator in charge of the Liberty, N. Y., sewage treament plant, forwarded some results of operation during the 1944 summer, with the following comments:

"As you will notice, our flow was very high during July and August (1.0 to 1.36 mgd), because everything was well filled up. On the Fourth of July it was almost impossible to travel on Main St., and some of the stores had to lock their doors a few hours each day because they couldn't handle so many people.

"We had a very dry summer, but the brook (which receives the plant effluent) looked very good. The effluent had no color whatever, and it was impossible to tell where it entered the brook. *I have noticed that when the flow is a million gallons or a little more, we seem to get better results than when it is 0.6 to 0.8 mgd.* Despite the hot, dry summer, I was unable to dry the sludge fast enough on the drying bed, so had to run the vacuum filter one or two days a week during August and September. It worked very well with the sludge from the heated digester. I could run off 6 or 7 cu. yds. in 5 or 6 hours, so that in 8 hours of operation I got about as much as we remove from one drying bed."

Since the load factor mentioned by Mr. Eichenauer seemed interesting, a check was made on operating results since the beginning of 1941. This plant is a biofilter, with two-stage recirculation facilities, and the effluent from the final clarifier is passed through a magnetite filter. (For a full description of the plant see PUBLIC WORKS for July and October, 1940). Operation began in the late summer of 1940. The plant is operated as a biofilter from May to about November, when there is a large vacation population, and as a straight trickling filter from November to May. The results given below cover only June to October results. In order to provide a clearer contrast, results were segregated on the basis of less than 900,000 gallons flow per day and more than 1 million gallons, the reports for flows between these rates being excluded. Results indicate raw BOD, BOD of secondary clarifier, and final BOD after passage through the magnetite filter.

Average B.O.D. in Parts per Million

Flows Under 900,000 gpd.

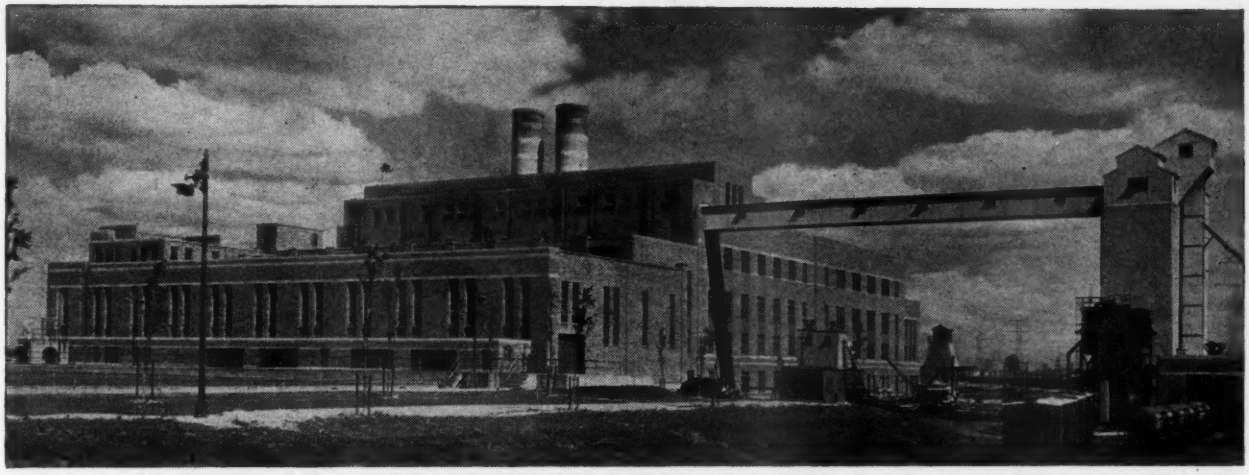
Year	*Raw BOD*	*Sec. Clar. Eff. BOD*	*Final BOD*
1941	445	21.1	7.1
1942	350	23.1	6.8
1943	355	26.3	8.1
1944	435	22.7	9.7

Flows Over 1,000,000 gpd.

1941	No flows over 1,000,000 gpd		
1942	280	23	6.3
1943	No flows over 1,000,000 gpd		
1944	490	21.2	5.3

In 1942, the number of days on which flows over 1 mgd occurred were very limited—too few to place much reliance on; and in view of the low BOD of the raw sewage, may have been influenced by rainfall. In 1944, flows in excess of 1 mgd occurred uniformly during the period June 27 to Aug. 3, and were very close to 1 mgd during the remainder of August.

There seems to be no considerable difference in the effluent from the secondary clarifier, but the final effluent does seem slightly superior at the higher rates of flow.



Pump and blower house and sludge disposal building, West-Southwest plant of the Chicago Sanitary District.

Test of Sludge Flow in a 16-Inch Cast Iron Pipe

Determination of the Williams & Hazen C for Imhoff and activated sludges at velocities of 3.4 to 5.4 feet per second in a four-mile length of pipe.

RECENTLY the Sanitary District of Chicago completed laying 27,370 ft. of 16″ cast iron pipe to carry sludge from the Southeast plant to 16 large lagoons with an average area of 5 acres each and 16 ft. water depth. The capacity of the plant for filtering and drying the sludge has been outgrown and war conditions prevent adding new mechanical units, hence the temporary adoption of lagooning for disposing of 125 tons (dry solids basis) of sludge per day.

The pipe line for two miles was laid parallel to a railroad in soil which would subject the pipe to vibration, and about 4,000 ft. of it was laid on top of the newly constructed lagoon levees, which were expected to settle more or less. For this reason the pipes were laïd with mechanical joints, the rubber gaskets of which allow deflection of 3° to 4°.

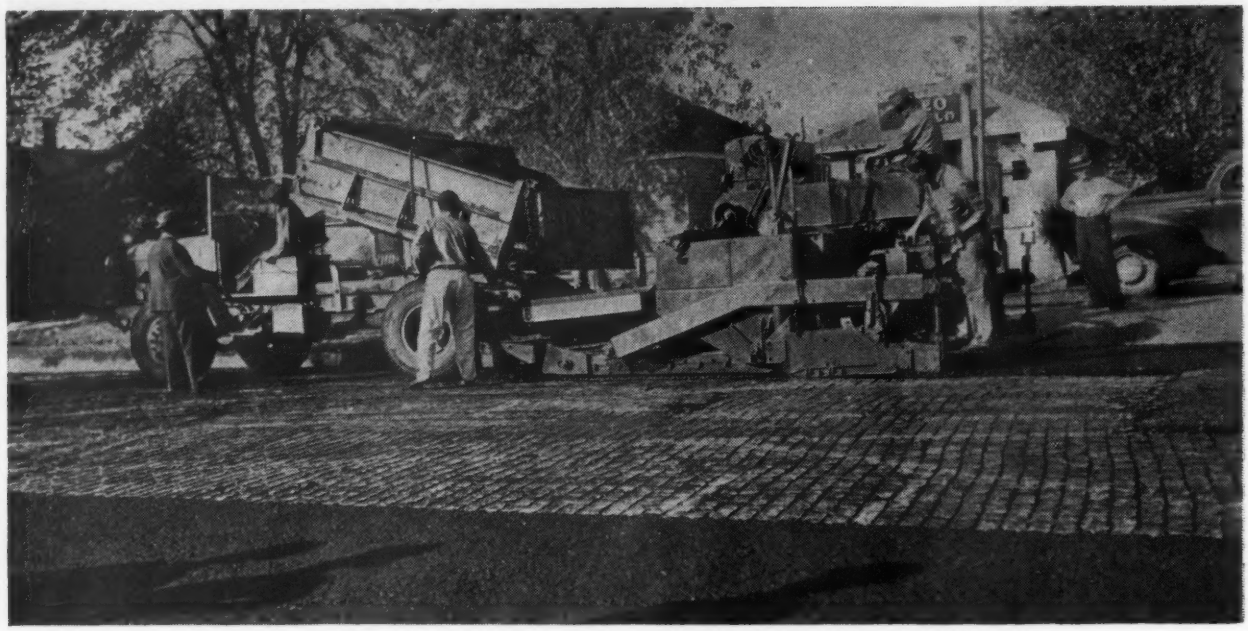
Sludge is pumped through this line at rates of 4½ to 6 fps, for it has been found that, with heavy sludges, the friction in the pipe decreases as the velocity of flow increases above 3 fps; also, the greater velocity is expected to decrease the formation of deposits in the pipe. This line, which has a smooth interior surface, proved to give less friction than had been expected and the impellers of the pumps were cut down to adapt them to the lower dynamic head.

Several flow tests were conducted on this line, the quantities being measured by a recording orifice flow meter. This meter was first checked against the displacement in a concrete tank for a 30-minute period, and was found to be 2.7% slow when measuring sludge of 2.48% solids at a temperature of 62° F, and in the calculations the readings were corrected correspondingly. Three pressure gauges were installed on the line, one at each end of the line and the third 1/3 the length from one end; these were calibrated with a dead-weight calibrating machine just before the test.

The pipe, which was cast in 18′2″ lengths, had an actual internal diameter of 16.20″ and the flow factors were based upon this. Had they been based upon the nominal diameter of 16″ the calculated value of *C* would have been 3 to 5 points higher. The line had

(Continued on page 36)

6,800 ft. of cast iron pipe laid with U. S. joint.



Barber-Greene bituminous finisher laying asphalt on old brick pavement.

How Clinton, Illinois, Resurfaced and Repaired Its Streets

Using funds furnished by the Motor Fuel Tax, the city resurfaced seven blocks of old brick pavement, using asphalt binder and rock asphalt wearing course.

By ROY H. LANE
Commissioner of Streets and Alleys, Clinton, Illinois

DUE to the traffic of heavy trucks, some of the streets of Clinton were getting in bad shape. The brick pavement was rough, patched and sinking in places, while the dirt streets were becoming rough with chuck holes. Building good streets and highways at any time is important, but now with the conservation of tires stressed by our government, it is a necessity. So we improved the arterial streets of Clinton this year, the project being financed with Motor Fuel Tax.

Ten-ton Huber gasoline roller.

The Motor Fuel Tax in Illinois is the only means by which villages and small cities can improve their streets without voting a bond issue, which would cause a heavier burden to fall on the taxpayers' shoulders. As it is, by using the Motor Fuel Tax, the ones who benefit most by good roads, the motorists, are the ones paying the tax to keep the roads in good condition.

As our Motor Fuel Tax fund grew, I suggested to the City Council that seven blocks of brick pavement, which were in very bad condition, be covered with asphalt. The Council approved the project and bids were advertised for, the lowest bidder being the Collins Construction Company of Decatur, Ill.

The company started the project soon after the contract had been awarded to them. This work began by spraying a prime coat of EA-1 emulsified asphalt on the old brick surface at the rate of .06 gallon per square yard. The material was heated and sprayed, using an Aeroil heating kettle and power spray.

Then a binder course 1½ inches thick was spread. This binder was I-11 Illinois State Highway Specification, using ¾" limestone.

The asphalt plant used for mixing the binder course

(Continued on page 44)

Missabe Mountain mine, lake and pump house.

Mine Water for the Water Supply of Virginia, Minnesota

Water pumped for draining a deep iron mine is filtered through pressure filters, gravity head being available, and is chlorinated and then repumped into the distribution system.

By M. C. BRIGHT
Superintendent, Water and Light Commission, Virginia, Minnesota

THE Water and Light Department of the City of Virginia, Minnesota, started out in 1913 with the purchase, from private interests, of a small water works and electric generating plant. At that time, ground water was plentiful adjacent to the power plant and needed only to be pumped from shallow wells. This water was of a good quality and required a minimum of treatment.

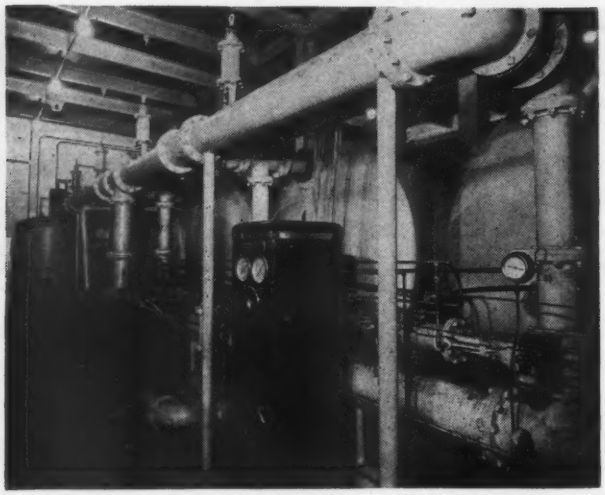
This city is located in the iron mining district of Northern Minnesota and the city itself is surrounded by open-pit mines. These mines have been deepened from time to time, and as the water level fell in the original wells due to pumping drainage water from the mines, these shallow wells were deepened and finally were abandoned in favor of four drilled wells, one of which was said to be 700 feet deep with 10" casing; all four of the wells being operated by airlift. (I say these wells are "said to be" of these depths because unfortunately no reliable information is available dating back to the time the wells were drilled.) The water supply from these wells was supplemented by water from a deep well owned by one of the mining companies and operated for drainage purposes adjacent to an open-pit mine at the city limits. This well was pumped by means of a deep-well turbine pump and some of the waste water from the mine pumping operations necessary to drain the mine was gathered and stored in a small reservoir located on a hill east of the city, from which reservoir the water flowed by gravity to the city pumping plant.

To summarize the above, prior to 1928 the city was supplied from three sources, namely:

1. Their own wells, four in number, air-lift operated near the power plant, which were gradually yielding less water due to mining operations.
2. A well with deep-well pump located on the edge of town, which supplied the city mains directly.
3. A small reservoir on a hill east of the city which utilized part of the waste water pumped from the Missabe Mountain mine.

This brings us to 1928, when it was found necessary, owing to the gradual failure of the wells at the power plant and the fact that the mining company found it necessary (due to increased mining operations) to abandon its deep well at the edge of town, to depend almost entirely on the waste water pumped to the East Hill reservoir, the third source mentioned above. It was, therefore, decided to construct a 1,500,000 gallon reservoir and settling basin at the East Hill in conjunction with the small reservoir already in use, and to make the re-claimed mine water the main city source of supply.

Accordingly, the reservoir was built in 1928 and provision was made for alum treatment to coagulate the slight amount of suspended matter contained in the drainage water. This treatment consisted of mixing alum in open tanks and introducing the solution into the water as it entered the reservoir, which acted as a sedimentation basin. The water was also chlorinated as it left the reservoir flowing to the city pumping



Pressure filters, Virginia water plant.

plant. At this time the maximum demand on the system averaged about 1,200,000 gallons per day. It was necessary to clean out the reservoir about once a year to remove coagulated sludge and iron ore.

This system was operated practically unchanged until increased activity in the mine and the opening up of a new drainage system in the mine, the driving of shafts and tunnels for drainage and the inflow of surface water, increased the turbidity of the water pumped from the mine to such an extent that the ordinary coagulation treatment with alum was inadequate. Also many complaints were received owing to the "pink" water which occasionally found its way into the domestic supply.

The mining company informed us that these conditions would become no better as time went on and consequently the Utilities Board realized that some provision would have to be made to filter the water in addition to the coagulation treatment at the mine settling basin or reservoir.

The possibility of both open gravity type rapid sand filters and pressure type filters was considered. Owing to the restricted space available and to the fact that water was available from the mine reservoir and settling basin at a pressure of about 40 pounds, it was decided to install pressure filters. Before proceeding with the purchase of this equipment, the writer visited some of the paper plants in Wisconsin where this type of equipment was in operation and where uniformly satisfactory results were obtained.

The decision was finally reached to install a Permutit pressure-type filtering plant consisting of five filtering tanks and the necessary piping and control equipment, provision for back washing, etc., and this equipment was purchased and installed in 1937 and placed in operation shortly thereafter.

The equipment has operated very satisfactorily, there being only one occasion where a break-down of the filter bed occurred resulting in dirty water, this being due to a mistake in operating procedure following a cloudburst which flooded the pumps at the mine.

After the installation of the filters, the system was practically complete as at present. However, the city still depended on the mining company pumping the waste water from the mine in the course of their operations and permitting the city to divert a portion of this water to their own use. In 1942 the mine, which had operated under lease for fifty years prior to this time, did not renew their lease with the State of Minnesota and prepared to give up the mine and remove their property, which included the pumping plant which supplied water to the city, the pipe lines connecting the pumping plant with the city reservoir and the electric transmission lines and other incidental equipment, all the property of the mining company.

In order to protect its water supply, the city entered into a special agreement with the State of Minnesota and the mining company whereby the mining company agreed, and was permitted by the State, to operate their pumping plant for the benefit of the city water supply, the city paying therefor a yearly rental on the equipment in addition to paying for the electric power to operate the pumps.

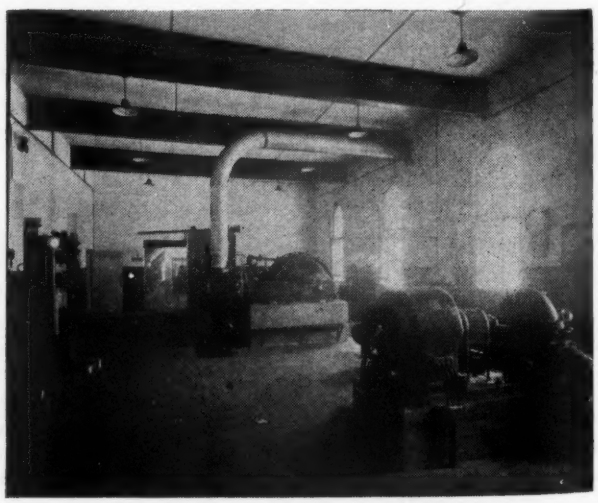
This arrangement with the mining company continued until March 20, 1944, when the company agreed to sell the complete pumping plant, pipe lines and all equipment to the city, and the city then took over the operation of the plant as an integral part of their water system. At this time, the city also negotiated a lease with the Lands and Minerals Department of the State of Minnesota for ground rights to occupy the site of the pumping plant, and also a lease was executed with another mining company which had taken over the lease on the mine at the expiration of the original fifty-year lease in March, 1942.

The city now operates the mine pumping plant for the benefit of the present lessee, inasmuch as the plant is used for mine drainage as well as city water supply. A mutually satisfactory arrangement has been negotiated between the city and the mining company which is the present lessee of the property, to share the cost of operating the plant, including the cost of electric power, maintenance, repairs, etc.

The system as it is at the present time can be described as follows: The source of the supply is the Missabe Mountain open-pit iron mine, located adjacent to the city limits. From here water is pumped by a city-owned plant, both for mine drainage and for the city water supply.

This plant consists of one 2,000 g.p.m. Layne & Bowler deep well turbine pump, 625 ft. total head, which pumps directly to the hill reservoir; one 2,000 g.p.m. Layne & Bowler deep well turbine pump, 155 ft. head, which pumps to a 2,000 g.p.m. Wilson-Snyder horizontal centrifugal booster pump, which pumps the water to the hill reservoir; and one 1,000 g.p.m. Layne & Bowler deep well pump, 155 ft. head, which pumps to a 1,000 g.p.m. Wilson-Snyder horizontal centrifugal pump which boosts the water

(Continued on page 34)



Pump room, Virginia water plant.

When you need special information—consult the classified **READER'S SERVICE DEPT., pages 71-73**

Making a Solids Balance at a Sewage Plant

(Continued from page 22)

grit removal and adding this to the computed removal from laboratory analyses; (2) by adding the total dry tons of screenings and grit removal to the actual removal. The discrepancy between the "total over-all computed removals" and the "total over-all actual removals" averaged 8.4% for 1943, ranging from 1.7% to 17.9%, based on the straight average of the monthly discrepancies. If the total tons over-all removal for the entire year is used, this 8.4% discrepancy reduces to 7.2%.

In addition to the monthly over-all solids balance reported above, a daily balance on *sludge filtration* is of considerable value in detecting when and what part of the system is in error; the meters, bucket elevators, filter cake conveyor scale, or the samples and analyses. If all the various quantities have been properly metered, sampled and analyzed, then the total solids input to the vacuum filters in tons should equal the total output from the filters in tons. The input consists of the dry solids in the sludge entering the conditioning tanks plus the chemicals added. The output consists of the dry solids in the filter cake plus those in the filtrate.

While it is impracticable to conclude the entire year's daily balance in this report, the range and average discrepancies from the average of the input and output for each month were as shown in Table 1.

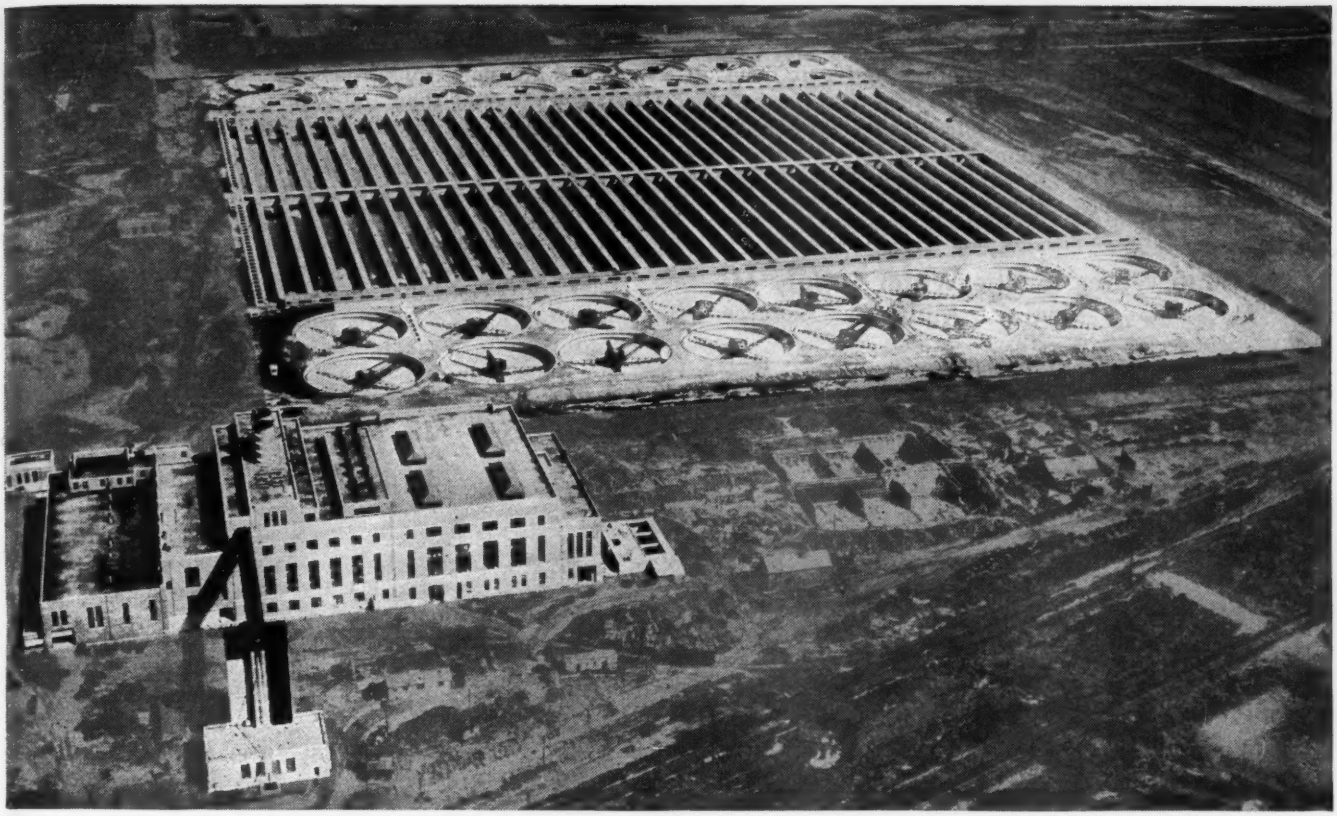
On the whole, the balance during 1943 was quite satisfactory. Whenever a poor balance between input and output is obtained, as indicated by some of the maximum discrepancies in Table 1, efforts are immediately made to locate the difficulty. In this way, any errors in the measuring equipment or in the samples are usually discovered and corrected much sooner than they otherwise might be.

Total monthly figures of some of the analyses are as follows: Incoming sewage solids (not including screenings and grit) average 11,119 tons per month of total solids, with a minimum of 10,366 in February and a maximum of 12,447 tons in August. The suspended solids average 3,886 tons, with a minimum of 3,587 in November and a maximum of 4,947 in January. Computed removals: total solids, 2,510 tons average, 1,975 minimum, 3,503 maximum. Suspended solids, 2,505 tons average, 2,056 minimum,

Table 1. Daily Sludge Filtration Solids Balance
Percentage of Discrepancy During Each Month in 1943

	Jan.	Feb.	Mar.	April	May	June	July	Aug.**	Sept.**	Oct.	Nov.	Dec.	Year
Min.	—0.2	0.0	—0.2	0.2	0.0	—0.1	1.1	...	...	0.0	0.0	0.0	—0.2
Max.	17.4	4.6	4.9	19.1	6.5	14.0	18.0	...	...	—10.1	11.9	7.7	19.1
Avg.*	5.9	1.6	1.1	2.5	—0.2	2.2	6.4	...	...	—3.0	1.9	1.4	2.1

*Based on total input and output for the month.
**The percentage discrepancy for neither August nor September was figured due to mechanical troubles with the filter cake scales.



Everdur BEGINS 11th YEAR OF SERVICE IN WORLD'S LARGEST SEWAGE PLANT

FOURTEEN MILES of Everdur* Conduit and 20,000 lb. of Everdur Fittings in Chicago's famous Southwest Sewage Treatment Plant, the largest in the world, are now well into their eleventh year of service under severely corrosive conditions.

Here, as in so many other notable installations, such as Ward's Island and Tallman's Island in New York, San Francisco, Bound Brook, Rahway and Elizabeth in New Jersey; Dearborn, Mich., and Hagerstown, Md., Everdur proves itself through years of dependable service the ideal metal for sewage plant equipment. This copper-silicon alloy combines strength, high resistance to corrosion with ready machinability and weldability. It is available in practically all commercial shapes.

For detailed information on Everdur Metal for sewage treatment equipment, write for Publication E-11. 45153

Reg. U. S. Pat. Off.

Everdur Metal

is used in sewage works for Coarse and Fine Screens, Swing Gates, Built-up Sluice Gates, Coarse Bar Rack Aprons, Effluent Weirs and Scum Weirs, Structural Scum Baffle Brackets, Troughs, Screen Hoppers, Orifices, Baskets, Anchors, Ladders, Float Gage Chains, Valve Springs, Manhole Steps, Guides, Walkways, Bars and Plates, Bolts and Nuts.

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When you need special information—consult the classified READER'S SERVICE DEPT., pages 71-73

3,458 maximum. Actual removal of sewage solids as filter cake: 2,591 tons monthly average, 2,050 minimum, 3,406 maximum. Screenings and grit removal, average 545 tons, minimum 291 tons (in December), maximum 1,016 tons (in June). Yearly totals: Suspended solids in incoming sewage, 46,637 tons; computed removal of total solids, 30,121 tons; actual in filter cake, 31,096 tons.

Mine Water for the Water Supply of Virginia, Minn.

(Continued from page 30)

to the reservoir. These pumps are all electric motor driven. The pumping plant, including reduced voltage starters, is housed on top of a 160-ft. mine shaft, the pumps having 150 ft. setting. These pumps have handled enormous quantities of abrasive material over a long period of time and, while they are in need of overhauling (which will shortly be done) they have proved very reliable and sturdy pieces of equipment, operating under difficulties and giving unfailing service.

From the mine the water is pumped to a 1,500,000 gallon reservoir located on a hill above the city, where it is coagulated with alum, chlorinated after about a twenty-four hour retention period, and allowed to flow by gravity to a pressure filter plant located at the main water pumping plant and generating station in the city. From the filters, the water flows into a 1,000,000-gallon clear well at the plant and from there it is pumped by the water works pumps into the system. These pumps consist of one-2500 g.p.m. Cameron and two-1000 g.p.m. Allis-Chalmers motor-driven centrifugal pumps. Located at the pumping plant is a 100,000 gallon standpipe.

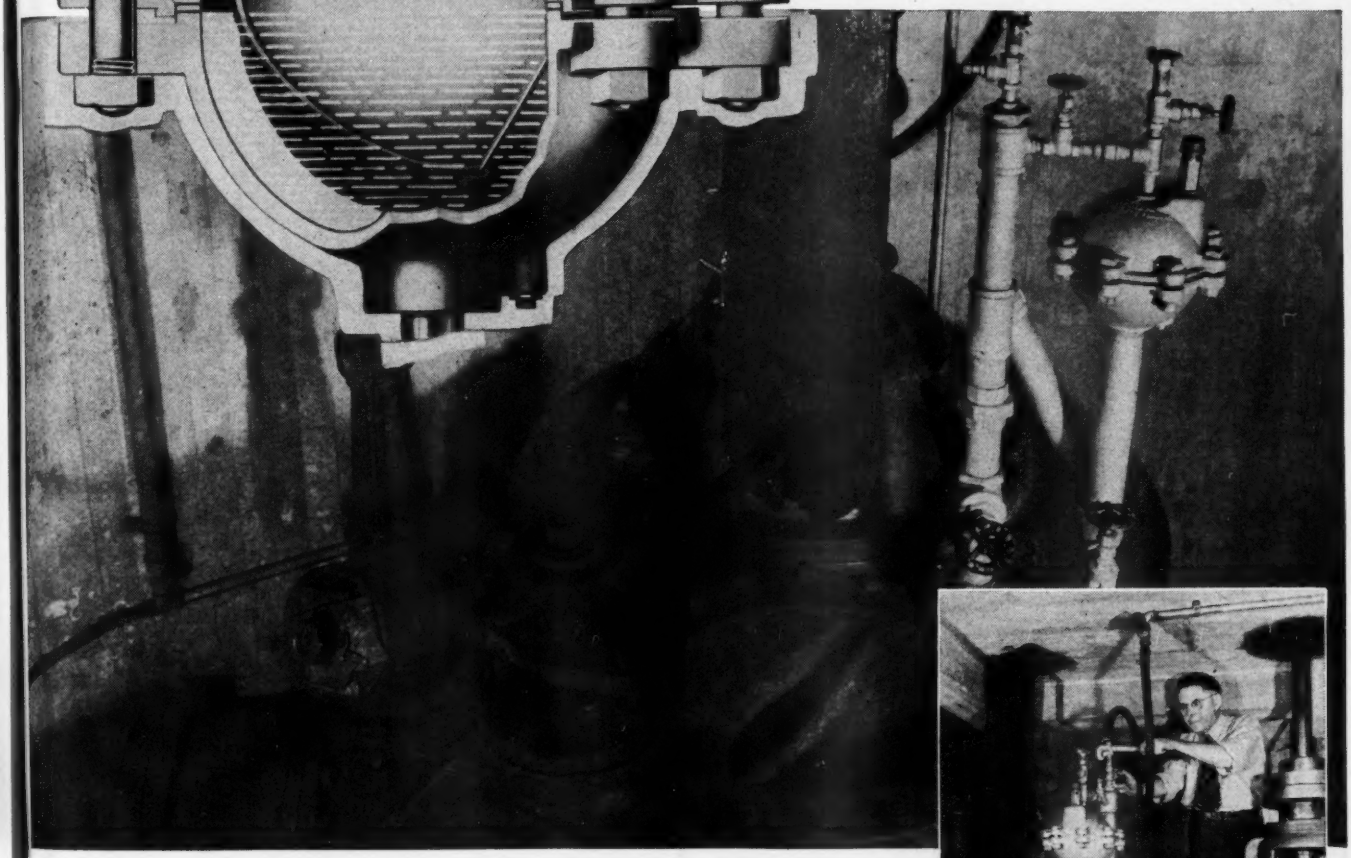
Combined in the main station, with the water pumping plant, the city operates a steam heating and generating plant.

A word regarding the operation of the filters. The filters are back-washed on a pressure drop of not to exceed 4 lb. which in the summer, with a flow of slightly in excess of 2,000,000 gallons per day, require back-washing twice a week. The filter beds have never been renewed since installation and still appear to be in satisfactory condition. Back-washing utilizes the full pressure and flow of a 12″ and a 10″ pipe line from the main reservoir at 40 psi and at a rate of about 13 g.p.m. per sq. ft. The normal average filtering rate is about 2 g.p.m. per sq. ft. All filters are equipped with flow indicators showing filtering rate of flow at each tank in g.p.m. per sq. ft. and back-wash rate in the same units. Back-washing is done by manually operating a master controller which automatically positions the valves for back-washing operations in successive tanks, of which there are five. It has been found that it is necessary to maintain about 4 ppm alum in the water entering the filters in order to get proper operation. The operation of the filters is judged by observing the floc that settles out in a sample of the effluent when back-washing. If this floc is of a fluffy nature like cotton finely suspended in the dirty back-wash water, we know the filters are operating properly.

Six million dollars' worth of post-war projects, part of the program of more than fifty million dollars of Allegheny County, Pennsylvania, is already in the "contract letting" stage. Most of the projects are not primarily plans to provide jobs but are necessary to improve the County highways.

The SIMPLEX AIR RELEASE VALVE

ELIMINATES SEWAGE PUMP SHUTDOWNS and MAINTAINS PEAK EFFICIENCY



FORMERLY, complete shutdown at least once a day — now, easy routine flushing* once a week! Simplex Air Release Valves at the Pottstown Sewage Works maintain peak operating efficiency of sewage lines and pumps — eliminate frequent and costly shutdowns caused by trapped air and gases from decomposing organic matter.

Simplex Type "B" Valves are especially designed to meet the particular conditions of sewage service. Construction is simple and dependable. There is but one lever movement which operates a needle valve so designed as to be always tight-seating. The valve is operated by a heavy thickness glass ball float, tested to several times the service working pressure. A cast iron shell houses the actuating parts which are of corrosion-resisting materials.

Simplex engineers will gladly assist in the solution of your sewage flow problems. Write today for details.

**Routine weekly back-flushing at Pottstown Sewage Disposal Works, Pottstown, Pa., accomplished merely by opening the valve below hose connection shown to allow clear water to fill the release valve and the system. Flush is quickly and easily completed without dismantling any part of the installation.*

SIMPLEX VALVE & METER CO.
6750 UPLAND STREET, PHILADELPHIA 42, PENNA.

When you need special information—consult the classified READER'S SERVICE DEPT., *pages 71-73*

Test of Sludge Flow in a 16-inch Cast Iron Pipe

(Continued from page 27)

been laid accurately to line and grade under engineering supervision; the mechanical joints gave perfect alignment of the pipe, which had a smooth surface, and there are no sharp angles in the line, either vertical or horizontal. These conditions undoubtedly contributed to the excellent results obtained.

Flow Test on 16.2" Cast Iron Pipe Sludge Line Using 4.6% Imhoff Sludge at 62° F. for 21,079 Ft. in Length

M.G.D. Rate	*Plant Press. Lbs.*	*Lagoon Press. Lbs.*	*Net Press. Drop Lbs.*	*Net Loss Corrected for Elevation, Ft.*	*Friction in Feet @ 1000 W & H Ft.*	*"C"*	*Vel. F.P.S.*
4,100,000	49.3	3.75	45.5	77.2	3.68	138	4.4
4,030,000	48.0	3.62	44.4	74.8	3.54	138	4.4
3,960,000	47.5	3.50	44.0	73.8	3.50	136	4.3
3,570,000	41.2	3.37	37.8	59.6	2.83	137	3.8
3,240,000	38.5	3.25	35.25	53.8	2.55	133	3.5
3,240,000	38.0	3.12	34.9	52.8	2.50	134	3.5
3,180,000	37.7	3.00	34.7	52.5	2.48	132	3.4
5,180,000	63.4	5.20	58.2	106.4	5.1	145	5.3
4,970,000	61.6	5.20	56.2	102.2	4.8	143	5.0

Flow Test on 16.2" Cast Iron Pipe Sludge Line Using 1.36% Activated Sludge at 62° F. for 21,079 Ft. in Length

4,030,000	46.7	6.25	40.45	65.7	3.11	147	4.4
5,250,000	69.6	10.75	58.85	107.3	5.10	147	5.4

Flow Test on 16.2" Cast Iron Pipe Sludge Line Using 1.36% Activated Sludge at 62° F. for 13,931 Ft. in Length

4,030,000	46.7	23.5	23.2	43.6	3.14	147	4.4
5,250,000	69.6	34.3	35.3	71.1	5.11	147	5.4

Flow Test on 16.2" Cast Iron Pipe Sludge Line Using 1.36% Activated Sludge at 62° F. for 7,148 Ft. in Length

4,030,000	23.5	6.25	17.2	22.0	3.08	148	4.4
5,250,000	34.3	10.75	23.5	36.5	5.10	147	5.4

Two sets of flow tests were conducted, one using activated sludge of 1.36% solids at a temperature of 62° F, and a second set using Imhoff sludge of 4.6% solids and having a temperature of 62° F.

The Imhoff and the activated sludges both gave Williams and Hazen coefficient "C" of 143 to 147 when operated at a velocity of 5 feet per second. The Imhoff sludge when pumped at 3.4 feet per second showed a "C" of 132. Tests conducted by other investigators have showed that, for velocities of from 1 to 3 feet per second and sludges having high percentages of solids (5 to 10 per cent), the coefficient C decreases rapidly, but that when the velocity is kept at 5 feet per second or better it approaches the same coefficient as used for clear water. The flow coefficient "C" is apparently governed by the velocity of flow, the percentage of solids, and the size of pipe used when handling sewage sludge.

The cast iron pipe line was constructed under the general direction of W. H. Trinkaus, chief engineer; H. P. Ramey and W. H. Faget, assistant chief engineers of the Sanitary District of Chicago. The design was prepared under the direction of Norval E. Anderson, engineer of treatment plant design. Construction was supervised by J. P. Della Martin, engineer of construction, and Ed. P. Mahoney, assistant civil engineer. H. R. King, senior civil engineer, and T. P. Ladd, junior civil engineer, cooperated in the hydraulic tests.

For the above information we are indebted to the Cast Iron Pipe Research Ass'n.

Cost of Refuse Collection and Disposal in Easton, Pa.

Easton, Pa., 1940 population 33,500, collected 6,508.35 tons of garbage and rubbish by city trucks in 1943, and disposed of it in the incinerator, together with 904.57 tons delivered by local truckers. City-owned equipment hauled 7,197 loads of ashes to the city dumps.

Collection of garbage and rubbish cost $15,552 for labor and $2,742 for trucks. Collecting ashes cost $19,732 for labor and $2,742 for trucks. Handling garbage and rubbish at the incinerator cost 89.45 cts per ton, supervision 17.75 cts, maintenance 24.96 cts and the cost of additional fuel averaged 10 cts per ton.

Stream Improvement Aims of the Paper Industry

The National Council for Stream Improvement of the Pulp, Paper and Paperboard Industries has established a research project at Manhattan College under the direction of Professor C. J. Velz, head of the Department of Civil Engineering. The project will consist of a sanitary analysis of the watersheds in which the industry is concerned and calculations of projected stream profiles for the purpose of determining the degree of responsibility of the pulp, paper and paperboard industries, in relation to other industries, for pollution of the streams, and point out what degree of abatement is necessary to return streams to a condition which will be satisfactory for uses to which they are put. This information will also help in guiding the research program conducted by the Council, which is concerned with treatment and recovery of wastes, and insure the industry against investment in inadequate treatment facilities.

Professor Velz is recognized in engineering circles as an authority on the subject of stream calculation, having been instrumental in developing the basic equations now in use when he was associated with Professor Earle B. Phelps of Columbia University. Assisting Professor Velz on this project, on a full-time basis, will be John Gannon, who worked with him on projects for the National Resources Board.

Damages for Destruction of Town's Sewer

In an action by a town to recover damages for the destruction of one of the town's sewers by pressure caused by a "mud-wave" created by the defendants, while constructing a tunnel for a neighboring city, by dumping large rocks in swamp land in proximity to the sewer, the New York Supreme Court (Westchester County, Town of Greenburgh v. J. F. Shea Co., Inc., 48 N. Y. S 2d 68) held that the town was, under the evidence, entitled to recover $70,000 as the reasonable cost of reconstruction of the sewer.

A contract between the landowners who had granted the town an easement to construct the sewer and the contractors who acquired the right to dump rock fill on the land where the sewer had been built, providing that the dumping should not damage the town's sewer, was held to be intended for the town's benefit, and therefore was enforceable by the town. The evidence showed that the town had constructed its sewer according to sound engineering principles so as to sustain strain reasonably to be expected.

Is *Your* Town Paying Too Much for Sanitation?

Fairbanks-Morse Pumps Reduce Costs Help Save Taxpayers' Money

TAKE the case of Englewood, N. J.—city officials realized sewage handling costs were too high and careful analysis indicated the need for a new system.

With an eye to the future they built a new plant, replaced the old equipment. Included in the new system were three Fairbanks-Morse Pumps. Two were 4" vertical sewage pumps with 500 and 700 gallons capacity respectively. One was a 5" vertical pump with 1200 gallons capacity per minute.

The Fairbanks-Morse Pumps were so much more efficient that the new plant showed a *ten per cent reduction* in sewage handling costs almost immediately.

Before long, Englewood's new equipment will be paid for by savings. And such cases are frequent. Oftener than not old pumps cost more to retain than to replace. Many officials of towns and cities are planning right now to ease the postwar tax burden of their citizens by savings in municipal services. Your resident Fairbanks-Morse Engineer will gladly help you get such plans worked out. To meet him, write Fairbanks, Morse & Co., Fairbanks-Morse Building, Chicago 5, Illinois.

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Diesel Locomotives • Diesel Engines • Generators • Motors • Pumps • Scales
Magnetos • Stokers • Railroad Motor Cars and Standpipes • Farm Equipment

When you need special information—consult the classified READER'S SERVICE DEPT., *pages 71-73*

Westchester County Leases Its Airport

(Continued from page 17)

During the term of the contract the county will take care of the structural maintenance of pavements and drains.

The concessionaire is to spend, over the life of the agreement, the sum of approximately $900,000 for the construction of an administration building, three large hangars, a number of multiple unit hangars, gasoline filling stations, aprons, control tower and other facilities. The concessionaire will take care of all maintenance with the exception of that previously mentioned.

The income level of residents in the area surrounding the airport is probably as high as that of any equally large area in the country. It is believed that this indicates a large number of private planes to be hangared at the airport. Our survey shows that a number of firms having offices in New York City or plants in Westchester and Fairfield Counties will make use of the field as a base for their so-called "executive planes," which will be used by their key personnel for traveling to various parts of the country. At first we were rather dubious as to whether we would get any scheduled airline operation, due to the nearness of our airport to New York City's LaGuardia and Idlewild fields. We found, however, that a survey made by one of the airlines had shown that more airline passenger traffic originated in Westchester County than in any other part of the metropolitan area and therefore it seemed that we should get a reasonable amount of airline service to satisfy this demand.

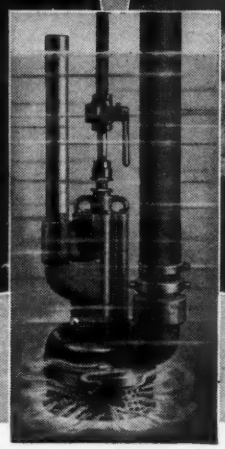
Under the concession agreement, the concessionaire will furnish all services generally found at a major airport including plane storage, aircraft sales, gas and oil sales, flying school, charter service, plane rental service, repair shop, restaurant, cocktail lounge, and facilities for airlines. All operations are to be under the control of the county, which exercises supervision over choice of sub-concessionaires, type of planes and other equipment to be sold, rates to be charged for services, operating personnel and other items.

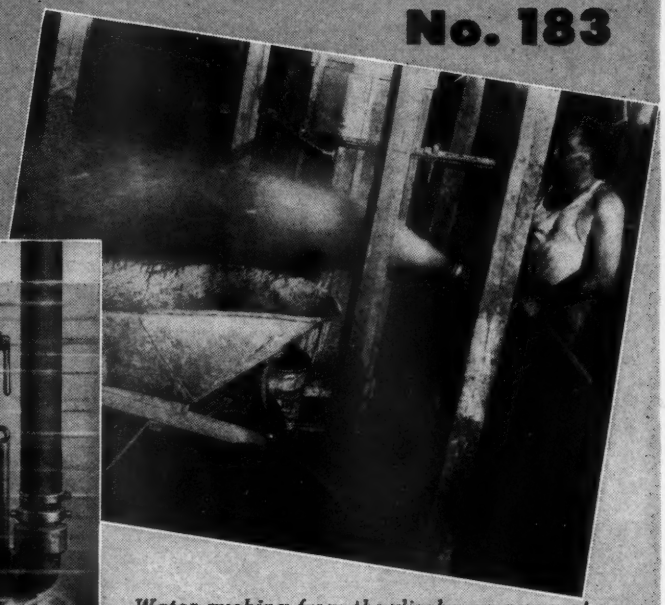
As payment for the concession, the county anticipates receiving under the term of the agreement 7½ per cent of gross receipts except receipts from airline ticket sales, charter ticket sales and gasoline sold to commercial airlines. The guaranteed minimum payment is $480,000. It will also receive the buildings erected by the concessionaire, for which, however, it must pay at the expiration of the contract the cost less depreciation at the rate of 7 percent per annum. A careful study of the successful bid made by our Budget Director indicates that the county will receive in cash and depreciated value of buildings over the period of the lease some $600,000 more than it will spend. This figure does not take into consideration, however, future expenditures in addition to the $400,000 to be spent by the county immediately, and the probabilities are, therefore, that our net gain will not be anything like this much.

We believe that this is the first time that major oil companies have interested themselves to such a large extent in airport development. The fact that these companies have been willing to put so much money into the project is indicative of their faith in the future of aviation in general and our airport in particular. We are pleased that the successful bidder is strongly

FAST PUMPING
with the CLECO-DEMING
No. 183

On this job the water dropped so fast that the operator stayed with his valve.





Water gushing from the discharge pump at over 200 gallons per minute.

THIS air operated pump has no equal for the rapid expulsion of liquids from sumps, basements, pools, ship holds, manholes, cofferdams, ditches, etc.

Weighing only 58 lbs., easily portable, the Cleco-Deming sump pump is self-priming, and operates without hesitation when wholly or partially submerged. A screen, easily removed for cleaning, prevents stones or trash from clogging the impeller. All working parts are Cammelite plated to prevent rust. Special design features insure adequate lubrication at all times. For use with oil or gasoline, a bronze body is available at slight extra cost to safeguard against sparks. Write for Bulletin 86.

While the armed services are using Cleco-Deming sump pumps extensively, our production facilities enable us to supply these pumps for commercial use also.

MEASURED CAPACITIES

With Air at 80 lbs. Gage Pressure

Against 10-ft. Head . . . 230 Gals. per Min.
Against 20-ft. Head . . . 218 Gals. per Min.
Against 30-ft. Head . . . 195 Gals. per Min.
Against 40-ft. Head . . . 170 Gals. per Min.
Against 50-ft. Head . . . 145 Gals. per Min.

Maximum Head, 75 Feet

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LEADERS IN DRILLING EQUIPMENT

backed by a large and responsible organization like the Gulf Oil Corporation.

Westchester County does not claim to be the first to let a concession for its airport on advantageous terms, but we do believe that we are the first county to lease an airport of this size under terms that would seem to insure our people getting the services afforded by a first-class modern airport at no net expense to its taxpayers. It is possible that time will show that we could have made more money running it ourselves; but at least under our plan somebody else will have to face the problems for fifteen postwar years, during which air transportation will be going through an experimental period. Furthermore, we have, to as great an extent as possible, followed that seemingly vanishing American custom of keeping the government out of commercial enterprise.

How Clinton, Illinois, Resurfaced and Repaired Its Streets

(Continued from page 28)

was a Cummer plant located at Decatur, and the mixture was hauled in insulated trucks a distance of 22 miles to the work in Clinton. The temperature of this mixture was approximately 300 degrees leaving the plant, and the heat loss on arrival on the job was approximately 15%.

The binder was spread by a Barber-Greene bituminous spreader at the rate of 240 tons per eight-hour day. It was then rolled first by a 10-ton 3-wheeled Huber gasoline-propelled roller, followed by an 8-ton Buffalo-Springfield steam-propelled tandem roller.

A wearing surface one inch thick of Kentucky rock asphalt was then spread over the binder course, using the same equipment for spreading and rolling. The material was heated in Decatur and hauled to Clinton in the same manner as the binder course. The material was shipped in coal cars to the plant in Decatur and was then heated by steam, using spuds placed at intervals in the car, for at least eight hours and brought to a temperature of 225 degrees. It was then loaded onto the insulated trucks by a crane using a one and one-half yard clamshell bucket.

After pavement had been laid, it was allowed to cure for a period of seven days before being opened to traffic. This was a longer period than usual on account of cool weather, this work being done during the week of October 16, 1944.

Since the Collins Construction Company completed the resurfacing project, I have received much favorable comment from the residents of Clinton to the extent that they would like to have the remaining brick pavement resurfaced in a similar manner.

As for the dirt streets, I have found, during my five and one-half years of experience as Commissioner of Streets and Alleys of Clinton, that the best care of dirt streets is to apply a heavy coat of road oil or cut back asphalt with a good blotter system such as sand, pea gravel or crushed stone. Before the oil is applied, I have the chuck holes filled with asphalt, unless the street is in bad shape, in which case I have the street graded first. This method will make as good a black top or dirt street as could be asked for if repeated three or four years consecutively. Clinton has several blocks of this type dirt streets that are standing up with heavy traffic.

This solution by Clinton of the problem of its rough brick pavement and arterial dirt streets has been successful in pleasing the taxpayers and motorists for I have received much favorable comment on both projects.

HERE'S HOW ENGINEERS "Outlawed" PAVEMENT BREAKUPS

This state's highway subdrainage program was speeded and simplified by use of long lengths of sturdy, flexible perforated pipe. Begun in 1940, the work continues, and pays dividends in firm, smooth, pavements that require little maintenance.

★ ★ ★

Until 1940, pavement breakups were as "reg'lar as groundhog day" each spring on certain New England highways. Then state engineers went into action with a thorough subdrainage program. Today that work is paying off in firm, smooth pavements, less maintenance work, reduced costs. A vital factor was—and is—perforated metal pipe that intercepts ground water in the trouble spots. They keep pavement foundations stable and firm.

You can "outlaw" costly breakups the same way with ARMCO Perforated Pipe. Installation is easy and fast, and costs are low—thanks to the long pipe lengths, fewer joints, light weight, and freedom from breakage. Once in the ground, ARMCO Perforated Pipe has the flexible strength needed to resist traffic weight and impact, vibration and disjointing. Perforations instead of open joints reduce the hazards of clogging.

Remember that good drainage is costly only when omitted. Write us for literature on Designed Subdrainage. Armco Drainage Products Association, 155 Curtis St., Middletown, Ohio.

ARMCO Perforated Pipe

When you need special information—consult the classified **READER'S SERVICE DEPT.**, *pages 71-73*

Postwar Air Fields and Aeronautics

The Civil Aeronautics Administration believes that it would be unwise to plan for less than 500,000 airplanes and 6,000 airports in 1945. This Administration has charge of issuing certificates, inspection of aircraft, airmen, schools, designation of civil airways and other executive functions, and is under the Department of Commerce. It classifies airports as Class 1, Class 2, etc. Class 1 is the smallest field recognized and is a sod field with landing strips 1800 to 2500 ft. long; Class 2 has paved runways 2500 to 3500 ft. long; Class 3 has runways 3500 to 4500, etc. The largest yet constructed is a Class 9 airport, with runways between 9,500 and 10,500 ft. long.

Says William C. Knoepfle, an airport engineer of the Administration:

"The principal elements to be considered in the selection of a new airport site are those of topography, drainage, obstructions, accessibility, expansion and cost. Each of these is important in itself and when all are considered together, we sometimes wonder how any site can fulfill all of the requirements. Naturally, it is desirable that an airport site be selected where the topography is as level as possible. If a site is too flat, we find that drainage costs are going to increase due to the flat grades and large sizes of pipe required. We have found that grading and drainage costs will somewhat offset each other. On a flat level site our grading costs will be lower and our drainage costs higher and vice versa.

"The accessibility of a site is also very important. Calculating the accessibility by mileage alone is deceiving as it really is not the mileage that is important but rather the travel time. Therefore, in selecting a new site we always consider the possibility of super-highways or rapid surface transportation that is, or may become, available. This problem is particularly important and difficult in the large metropolitan areas.

"Obstructions are always bad in airport planning regardless of whether it is a new site or the improvement of an existing airport. It is surprising the high value that a few trees can acquire when the city begins to dicker with a farmer for their removal. Power and telephone lines are another bad feature that must be avoided but we have found that most utility companies are very cooperative.

"While we plan for an airport of a definite size, it is always desirable to select a site which can be expanded in the future. Therefore, we try to secure a site that is not limited by railroads, rivers, highways or other valuable improvements."

Michigan's Road Magnet

Michigan's State Highway Department used, during the fall of 1944, a road magnet for removing from the state trunkline highways any metal objects which there might be on the surface and which might injure tires of vehicles.

The magnet is primarily a large roller attached to a two-wheel trailer and towed behind a maintenance truck at a speed of about 8 miles an hour. A generator, mounted on the trailer, magnetizes the roller, which is made to revolve slowly by a belt driven from the wheels on which trailer moves. As the roller revolves forward it becomes demagnetized at the point where nails and other ferrous metals approach a bin, thus permitting the potential puncture-makers to drop into the receptacle.

The magnet will pick up anything from a small tack to a crowbar. Bottle

BIG SQUEEZE COMING UP

Cracking, breaking down under pressure of heavy war trucking . . . neglected unavoidably because of manpower shortages . . . America's roads are crying for immediate attention.

Meanwhile, the need for completing postwar highway plans to meet the demands of a new era of transportation is becoming increasingly imperative.

Result: There is a big squeeze coming up. To be ready, maintenance and postwar planning must both go forward at the same time! It's none too soon to consider your part in this situation.

That is why we suggest that you call in the Tarvia field man. He can offer you the benefit of Barrett's 40 years of successful experience in road construction, maintenance and repair. He can show you how to use Tarvia with local materials, to get the most miles of smooth, non-skid, long lasting pavement for the money available.

He can help you solve your postwar highway problems—now.

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Providence . . Rochester . . Minneapolis . . Cleveland . . Columbus . . Toledo . . Youngstown
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*Reg. U. S. Pat. Off.

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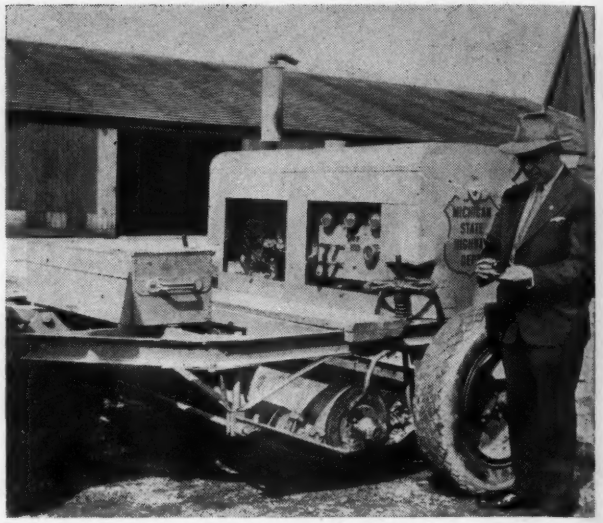

Michigan's Road Magnet.

caps, nails, spikes, bolts, pieces of tin cans and countless other sharp objects were picked from Michigan pavements, shoulders near the edge of pavements, and gravel roads, the biggest haul coming from pavements. The magnet works excellently on pavements and on loose gravel but will not pick up ferrous metals embedded in stabilized gravel roads. There is no danger of anyone receiving a shock by touching the apparatus.

Commissioner Ziegler reports the magnet removed 1,300 pounds of ferrous objects from 1,448 miles of trunkline pavements and 152 miles of gravel roads, approximately ¾ of a pound per mile.

(In September 1931 PUBLIC WORKS described a similar device used by the North Dakota Highway Department which in 1930 collected 13,891 pounds of metal, an average of 11.9 pounds per mile.)

Potato Dehydration Wastes in Sewage

Grafton, N. D., operates a standard trickling filter and separate sludge digestion plant to treat its sewage, designed for a population of about 6,000. When a potato dehydration plant located there and went into operation, its wastes constituted approximately one-fourth of the total sewage flow. Describing the effect of this waste on the treatment plant, E. L. Lium said (in a paper before the N. Dakota Water and Sewage Works Conference) that only a few days after the potato dehydration plant went into operation the effluent from the treatment plant was coal black. The strength of the effluent jumped up to around 400 parts per million B.O.D. Relative stabilities, following running more than thirty days, failed to stand up for more than a day or two. Following complaints from down stream riparians and six damage suits, the Grafton City Council took action in May 1944 to prohibit the potato dehydration plant from discharging its wastes into the municipal sewer system, unless the industry would guarantee to protect the city from any damage suits that may arise and from any damage that may result to the treatment plant, and to post a surety bond to guarantee such protection, such bond to be retroactive to the time the potato dehydration plant originally started operation, and to continue active for five years in the future. The industry, failing to meet these terms, was dismantled and moved its plant to Richfield, Utah.

A Half Century of Keeping a Water Plant Up-to-date

(Continued from page 20)

water level and can operate his pumps accordingly. This piece of equipment has proved very valuable. For a time the operators used a long telescope to observe the target on the tank and it is even yet used occasionally if the Telemeter line gets broken. It often amused visitors to see a man come out of the door of the pumping station and carefully sight a long brass telescope towards the town, as they could have no possible way of knowing what he was looking at.

In spite of the fact that all water is raised from a static level of 35 feet below ground against a head of 70 feet from the ground level to the standpipe level and then repumped against the transmission line pressure, virtually two pumping operations, the average power used is less than 1 kwh per thousand gallons delivered. The power cost averages 1¢ per kwh, so the pumping cost for power is 1¢ per thousand gallons. (Actually $0.0093.)

The city pays the Water Department $25 per year for each hydrant and in addition pays for all water used by the city departments, except for fire. The Water Department in return is expected to pay the city such funds as are ordered to be paid by the City Council after all expenses, including bond interest, have been paid, as provided by law.

WELLS AND PUMPS

Wells				*Pumps*					
No.	*Size*	*Depth*	*Date*	*No. Pump*	*Make*	*H.P.*	*Size*	*Capacity GPM*	*Volts*
1*	5⅝	150	1908						
2*	6	150	1908						
3*	10	150	1925						
4	10	233	July 1935	10	Peerless	40	8″	1100	220
5*	12	273	June 1940						
6	12	127	Dec. 1942	12	Peerless	60	10″	1750	220
7	12	143	Feb. 1944	10	Peerless	30	8″	750	220
8	12	152	May 1944	12	Peerless	75	10″	1150	2400

BOOSTER PUMPS

	Pumps					*Motors*			
No.	*Mfr.*	*Size*	*Type*	*Head*	*GPM*	*H.P.*	*Make*	*RPM*	*Volts*
1	Worthington	6″	6L-3	150′	1000	100	Worthington	1750	2200
2	F.M. & Co.	4″	Fig. 800E	150′	300	20	G.E.	1750	220
3	F.M. & Co.	6″	Fig. 800E	150′	600	30	F.M. & Co.	1750	220
4	Worthington	5″	5L-2	139′	900	50	G.E.	1750	220

*Abandoned

WATER WATER ANYWHERE—

Safe and Good to Drink!

Photo U. S. Coast Guard

Official U. S. Marine Corps Photo

Pure drinking water is an essential item for every member of the amphibious forces when landing on invasion beaches, as in this landing on Leyte Island, in which the Stars and Stripes were raised at H-Hour plus two minutes. Thanks to HOODCHLOR this insurance is now easy. We are happy to have a part in thus maintaining the health of our armed forces all over the world.

HOODCHLOR

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HIGH TEST HYPOCHLORITE

When HOODCHLOR is fed into the drinking water supply it quickly destroys and prevents growth of dangerous bacteria. This high test calcium hypochlorite in free-flowing granular form retains its strength for a year or more. Rapid rate of solubility enhances its convenience.

HOODCHLOR is widely used in this country by municipal and private water systems of not over 500,000 gallons daily capacity and by larger works for emergency use. It destroys slime and algae in reservoirs, tanks and mains.

HOODCHLOR is also extensively used in sewage treatment, and for sterilizing swimming pools. Many municipalities keep a supply on hand for emergency use when fires, explosions, floods, or other disasters disrupt the regular supply.

Send for descriptive folder and price list.

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Executive Offices: 1819 Broadway, New York 23, N. Y.

Factory: Akron, Ohio

HOODCHLOR HIGH TEST CALCIUM HYPOCHLORITE · CAUSTIC SODA

BICARBONATE OF SODA · SODA ASH · CHLORIDE OF LIME

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is now shipped in convenient reseal-able steel pails, lined with chlorine resistant lacquer. Net weight 25 pounds. Also packed in 3¾ lb. cans, 12 to the case; and 5 lb. cans, 9 to the case.

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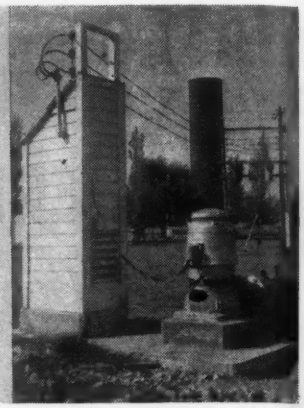

Showing method of connecting c.i. pipe to "Century" pipe. **No. 7 well and transformer bank.**

The waterworks system is under the control of a Board of Water Commissioners consisting of three commissioners appointed by the Mayor and approved by the Council for a term of six years each, and the Mayor and the City Clerk, who are ex-officio members of the Board.

Illinois Public Water Supplies

The Division of Sanitary Engineering of the Illinois Dept. of Public Health, of which William J. Downer is chief sanitary engineer, has compiled comprehensive data concerning the public water supplies, as of June 1, 1944, from which the following summary has been prepared.

There are in the state 699 municipalities with municipal water supplies, of which 653 are publicly owned. These are obtained from 594 sources, of which 480 are groundwater supplying 1,409,362 consumers in 493 municipalities, and 112 are surface water supplying 4,909,534 in 206 municipalities. One hundred and eleven communities are supplied by other municipalities, of which 39 are supplied by Chicago and 17 by East St. Louis.

Of the 480 ground supplies, 229 are rock wells, 230 are drift wells, 9 are combined rock and drift, and the other 12 are springs, combined well and springs, a mine shaft and an infiltration gallery and wells.

Of the surface supplies, 11 draw from Lake Michigan, 39 from streams and 62 from impounding reservoirs.

Chicago and the 39 suburbs served by it had an average consumption of 975.5 mgd, or 261 gal. per capita. The remaining 659 municipalities consumed an average of 177.5 mgd, or 69 gal. per cap.

Ipava, population 629, has the distinction of using water with the highest mineral content at the source —2964 ppm, of which 2.7 ppm is iron and 625 is hardness. This water is from a rock well driven in 1890. The only treatment is chlorination.

The water used by St. Elmo, population 2,290, contains less mineral content than any other supply in the state—65 ppm, of which 33 is hardness and none is iron. This is obtained from a creek.

The hardest water is that used by Western Springs —943 ppm, of which 408 is carbonate hardness. This comes from rock wells and is treated by softening, iron removal and chlorination, after which the hardness is only 114 ppm, none of it carbonate. The iron content also is reduced from 1.5 ppm to 0.02.

The softest water is at New Baden, drawn from rock wells. The hardness is only 12 ppm and the iron content is 0.3 ppm.

RIGHT DRESS ...FOR TOMORROW

When Johnny and his buddies come marching home, it's up to every community to have plenty of big jobs for their own men to do. One sound way to insure the future of your local citizens is to plan important public works projects NOW—projects which will give your men the steady employment they'll need during the period of "war-to-peace conversion."

The manufacture and installation of Lock Joint Concrete Pipe for your water supply lines, sewerage and drainage programs provide one of the best methods for putting your local men to work quickly—right in your own home town. Past experiences have proven that by erecting temporary local plants as much as 90% of your local labor can be used in building these dependable and economical pipelines. In addition, the Lock Joint Pipe Company buys the bulk of supplies and materials from your own merchants—and thus, most of the cost of the project remains in your community.

Whether your project is large or small, for the present or the future, your 'phone call, telegram, cable or letter to any of our offices will bring a prompt reply.

LOCK JOINT
Reinforced Concrete
PRESSURE PIPE

LOCK JOINT PIPE COMPANY
Established 1905
AMPERE, NEW JERSEY

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Joplin, Mo. • Valley Park, Mo. • Cleveland, Ohio • Hartford, Conn. • Navarre, Ohio

SCOPE OF SERVICES *Lock Joint Pipe Company specializes in the manufacture and installation of Reinforced Concrete Pressure Pipe for Water Supply Mains as well as Concrete Pipe of all types for Sanitary Sewers, Storm Drains, Culverts and Subaqueous lines.*

When you need special information—consult the classified **READER'S SERVICE DEPT.**, *pages 71-73*

The average hardness of all the surface waters of the state is 139 ppm; and of the ground waters, 328 ppm.

Of the 6,318,896 population served by public water supplies, 5,724,861 receive chlorinated water. Chlorination is the only treatment of 75 supplies, 74 of them ground water. Of the 112 surface water supplies, 97 receive "purification" (presumably filtration) and chlorination; 13 purification, softening and chlorination; and 2 rechlorinate. Of the ground water supplies, none are filtered, 27 receive softening, iron removal and chlorination; 39 softening and iron removal; 33 iron removal only; 11 iron removal and chlorination; 6 softening only; 2 softening and chlorination; and 1 chlorination for emergency.

Of the 581 pumping plants operated by 497 municipalities, 145 are oil-lubricated turbines, 43 water-lubricated turbines, 122 turbines whose lubrication was not stated; 38 are air lifts; 164 are plunger-type deep-well pumps; and 68 are suction.

Of the sources of power for these pumps, 534 were electricity generated by a privately owned utility; 36 electricity generated by a municipality; 10 were electricity, ownership not specified; 99 were gasoline engines; 35 were oil engines; 49 used coal; 2 were operated by tractor; one used a water ram.

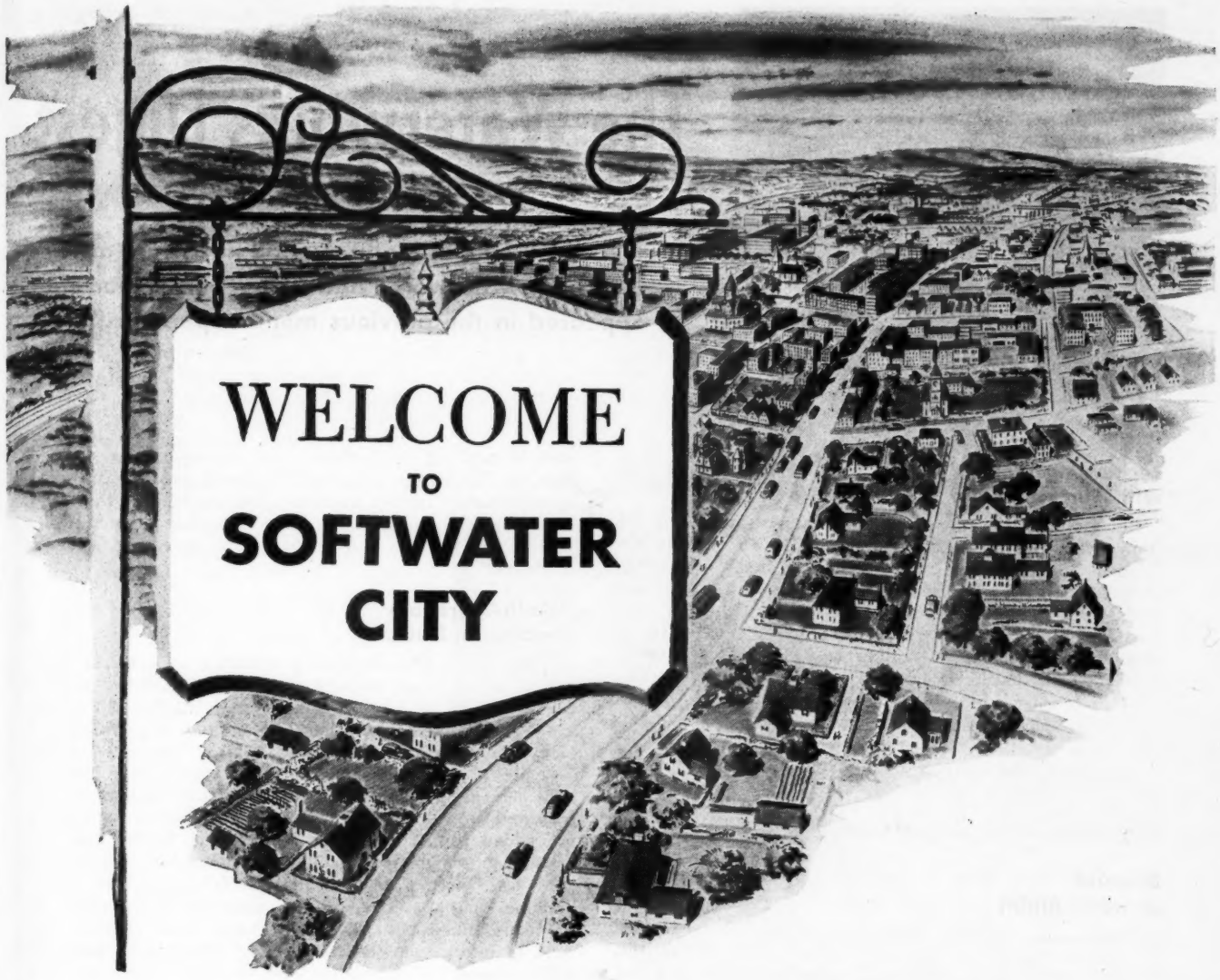
Liability for Leak in City's Water Service Line

In Pennsylvania a property owner may recover from a municipality for the injury caused to his premises by water escaping from a service line in the municipality's exclusive control and situated under the roadway of a public street, where the municipality fails, in this case for a period of ten months after it has been apprised of the possibility of a defect, to inspect and repair the pipes at the place complained of. The property owner would have the burden of showing that the damages resulted from the municipality's negligence. The plaintiff in a recent case showed that his property was injured by the water escaping from the line, followed by unreasonable neglect in repairing the line after actual notice, or for so long a time that the jury could infer negligence on the part of the municipality officials in not discovering the defect in the line even without notice. The fact that the moment the water was stopped off from entering the extended pipe, the leak stopped after all other efforts to discover it had been exhausted without any success, showed that the leak was in this pipe, and as it was a pipe over which the property owner had no control and the city had exclusive authority, the responsibility for its defects was held to be cast upon the city. Hinders v. City of Pittsburgh, Pennsylvania Superior Court, 38 A. 2d 420.

Most Accidents Happen Near Home

Analysis of traffic accidents reported to the Minnesota Highway Department in 1943 showed that 91.8 per cent of the drivers involved lived within 25 miles of the place of the accident, 5.6 per cent lived elsewhere in the State and only 2.6 per cent were non-residents. This contradicts the belief that out-of-state drivers and other long distance travelers are responsible for most of the accidents.

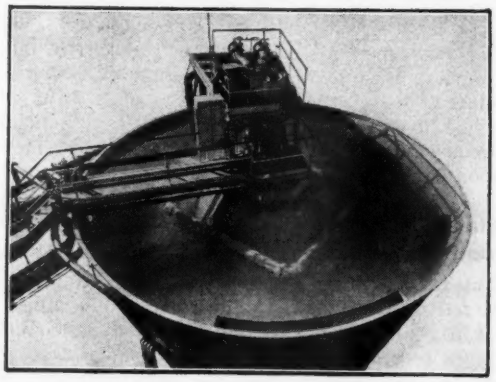
Long distance travel in 1943 was below normal, but in 1941, 86.1 per cent of the drivers in reported accidents lived within 25 miles of the accident, 9.3 per cent elsewhere in the State and 4.6 per cent were non-residents.



IT'S A BETTER PLACE to live, work and play. Because, you see, *this* city has *soft* water—conditioned by Permutit*.

Permutit removes the hardness and other impurities found in city water supplies, makes the water soft, clear, iron-free. It brings new luxury, labor-saving and cleanliness to every family in town... attracts new business and industry. Hundreds of modern cities have found this out after installing Permutit equipment.

Make *your* city a better place to live in! Write *now* for details to The Permutit Co., Dept. G-4, 330 West 42nd Street, New York 18, N. Y. or Permutit Co. of Canada, Ltd., Montreal. *Trademark Reg. U. S. Pat. Off.



PERMUTIT SPAULDING PRECIPITATOR removes water hardness, dirt and color by the sludge blanket process. This new-design equipment cuts detention time, saves chemicals, takes only half the space of former methods. Present installations handle capacities up to 120,000,000 gallons daily.

PERMUTIT

SOFT WATER for modern cities

WATER CONDITIONING HEADQUARTERS

When you need special information—consult the classified READER'S SERVICE DEPT., pages 71-73

Racine, Wisconsin, filter room

The Waterworks Digest

Abstracts of the main features of all important articles dealing with waterworks and water purification that appeared in the previous month's periodicals.

Recharging Wells With Surface Water

Louisville, Ky., draws its public water supply from the Ohio river, and it usually is as warm as 85° during the summer. This is too warm for use as cooling water by the various distillers, and these use ground water from wells about 100 ft. deep. During the winter of 1943-44 they were pumping 62 mgd, which was 20 to 30 mgd greater than the replacement rate. The U. S. Geological Survey recommended that they use city water during the winter when it was cool, and at the same time inject it through wells into the underground reservoir; which reservoir is a basin in limestone and shale bedrock, which can be filled many feet higher before overflowing to an outlet. This plan was adopted last March, and use of groundwater renewed in June. The results were very close to those calculated by the Geological Survey.[F6*]

Bacteria In Water Mains

Bacteria are present in all water, even in the effluent of the best filter plant carrying 0.3 ppm residual chlorine. "Total count" is a misnomer unless qualified by the phrase "on standard nutrient agar incubated at 37°C for 24 hr." If such a plate be incubated for 72 hr. at 20°C it will produce many colonies; and, if in the absence of oxygen, an abundant crop of different bacteria will be produced. Most of the bacteria found in water pipes are attached to the pipes, forming slimes. Among the most common are Crenothrix, Beggiatoa and Thiobacillus Thiooxidans.[A19*]

Water Demands at Canadian Airports

This article discusses data from air training schools scattered on the Canadian prairie for 300 miles west of Winnipeg and 300 miles north of the U. S. boundary. Each is a complete community of itself, varying in size from 107 to 2400 people. The water supplies were obtained from wells or adjacent municipalities. Design capacities and hourly fluctuations were based on experiences of the first World War, revised to a minimum of 48 gpd per capita. The actual fluctuations at these schools varied from the old data, probably due to changing habits, type of men and equipment. The illustration shows the per capita demand at 135 schools during four years.

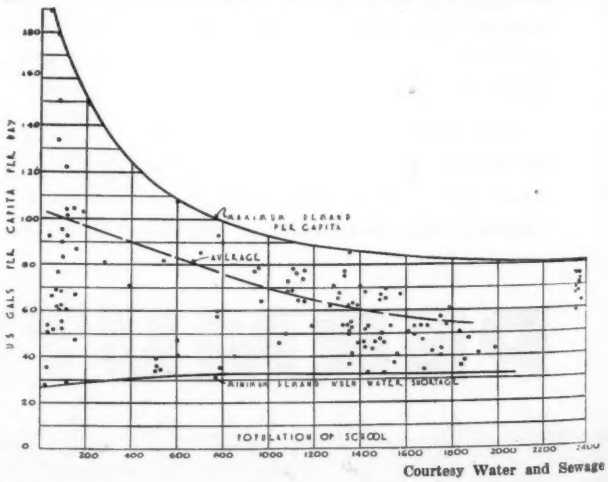
At the schools included in the survey the toilets and water faucets were attended to in order to prevent waste, and urinals were equipped with spring taps. On this chart the minimum curve indicates the lowest demand that will keep the school functioning under strict management. The average curve shows the demand that will keep the school functioning comfortably. The maximum demand curve indicates the requirements where water is plentiful and the maintenance is not strictly controlled, with spray pipes on urinals running continuously, for example. It was found that the elimination of automatic flushing for urinals saves approximately twenty to twenty-five per cent of the water and that for any particular school the demand per capita will rise and fall with a change in operating superintendents.[M2]

*See Bibliography in the January issue.

Alkali-Aggregate Reaction in Dams

Large-scale random-pattern cracking of concrete dams has occurred in all sections of the United States. Expansive reaction between aggregate and high-alkali cement has been found responsible for the random cracking and deterioration of the concrete of a large number of dams. The binding of gates and of generator rotors, the misalinement of generator and turbine shafts, and the straining and breakage of guide vanes and other machinery embedded in concrete have been traced to the excessive expansion which accompanies such reaction. Aggregates that have been found to react with high-alkali cement include opaline silica, highly siliceous rocks (such as siliceous limestones, chalcedony, and some cherts), and acid to intermediate volcanic rocks. These same materials have caused no trouble in service when combined with cement low in alkali content.

Aggregate which will give this trouble in concrete may be recognized if it produces expansion within a short time in test specimens made with high-alkali cement. Absence of such expansion in a short period is no guarantee, however, against a latent type of reaction, for which no reliable accelerated test has appeared. Prudence dictates that aggregates known or suspected of adverse activity be used only with cement of low-alkali content or not at all. Low-alkali cement is recommended generally for all concrete in hydraulic structures as its use provides security against the uncertainty of encountering expansive reaction,



Courtesy Water and Sewage

Demand per capita for all purposes at Canadian air-training schools.

and otherwise improves the general quality of the concrete.

No specific preventive for alkali-aggregate reaction has as yet been discovered although the problem is under intensive investigation. Specification of low-alkali cement, while admittedly inadequate, is the only recourse available to engineers at the present time.[K1]

Utilizing Ground Water Shortage

Complete development of water supplies for irrigation in the United States will require the greatest possible use of the underground portion of the streams and of the storage capacity resident in the unconsolidated alluviums of the stream valleys. Successful use of ground water in irrigation requires that:

(*a*) Ground water in the alluvium is readily accessible to extraction by pumps;
(*b*) The alluvium is sufficiently permeable to yield water in commercial quantities;
(*c*) The alluvium is naturally charged with water or is susceptible of being charged artificially to such an extent that heavy commercial drafts can be sustained;
(*d*) If artificial charging is necessary it can be done at feasible cost.

If the specific yield can be determined, the water capacity of the underground reservoir can be calculated. Meinzer lists seven methods for determining it:

A. Direct Determinations of Specific Yield:

1. Laboratory saturation and drainage of columns of alluvium;
2. Field saturation and drainage of alluvium as it lies in place;
3. Determining from samples the specific retention and porosity after water has been drained in field;
4. Pumping from ground water, exporting or using the water and observing the volume of alluvium unwatered; and
5. Observing the volume of water entering alluvium and the corresponding volume of the alluvium in which a rise in water table occurs.

B. Indirect Laboratory Determinations of Specific Yield:

6. By the centrifuge; and
7. Mechanical analysis and determinations of porosity, estimating therefrom the specific retention and specific yield.[K3]

Water Conservation In Washington, D. C.

The Commissioners of the District of Columbia in December 1943 set up a Sub-committee for the Conservation of Water, which laid out a broad program, which included publicity and physical aspects. Among the latter, attention was given to public display fountains, automatic flushing, abandoned services, air conditioning, street flushing, etc. Pitometer surveys to locate leaks or waste were resumed. A program of meter inspection and repairs was accelerated. Health and building inspectors and police were asked to report all leaks.

In less than a year the efforts of the Sub-committee had resulted in saving an estimated 4,445 million gallons a year. This included 18 m.g. in abandoned services; 175 m.g. in visible leaks; 95 m.g. in invisible leaks; 331 by pitometer surveys; 96 at horse troughs; 48 at fountains; 109 by automatic flushers; 33 in air conditioning; 151 by defective meters; and much of the remainder by citizen cooperation. It is proposed to put the work of this sub-committee on a permanent basis.[A20*]

Water Conservation In Philadelphia, Pa.

The water conservation program in Philadelphia included a pitometer leak and waste survey, which has discovered 30 mgd with the survey 90% completed. Pressures were regulated; routine hydrant inspections were

made quarterly instead of semi-annually; police supervised hydrant usage; the water bureau supervised use of water for victory gardens, and urged conservation through the newspapers.

Of the leakage discovered, 6.8 mgd was in broken mains, 2.8 mgd in joints, 7.1 in abandoned services, 5.8 in service leaks, 0.9 in abandoned services. Underregistering of 58 meters was found totaling 5.2 mgd.[A21*]

Licensing Water Works Operators

Texas is believed to have been the first state to inaugurate licensing of water works operators. In 1933 Water Works Short School appointed a rating board to issue three classes of licenses, and some grade C licenses were issued, and grade A and B licenses in 1934. In 1935 this board was made permanent. Application is made through the State Dept. of Health to the Advisory Licensing Committee, examinations held, and certificates issued by the State Dept. In 1943 some changes were made in the examinations and licenses, recognizing the four branches of administration, production, control and distribution. The state has issued over 2,000 licenses to waterworks men. The licensing is purely voluntary, but it is impossible for a public water supply to obtain approval by the State Dept. of Health without having licensed employees.[A32]

In California, certification applies only to operators of treatment plants. It was inaugurated in 1936, with three grades, as in Texas. Examinations are both oral and written, the latter consisting of "true-or-false" questions and three or four of the discussion type. There are now 168 certified operators, 34 of Grade 1, 72 of Grade 2 and 58 of Grade 3.[A27]

The Arkansas Water Works and Sewerage Conference in 1939 authorized a committee to prepare a plan for voluntary licensing, adopted the plan in 1940, and the first examination was held at the 1941 Conference. To date 34 men have qualified for Grade A licenses, 29 for Grade B and 11 for Grade C.[A26]

The Louisiana State Dept. of Health has sponsored a program for voluntary certification for three classes and the first examination was held in 1941 for Class C certificates, and 34 certificates issued. The examinations are both oral and written, the latter being merely of the "true-or-false" type. In 1942 examinations for Classes B and C certificates were held, and in 1943 for all three. In 1944, 6 took the Class A test and 2 passed; 9 took Class B and 5 passed; and 7 took Class C and all passed.[A28]

Oklahoma began its short school for water plant operators and superintendents in 1922, and in 1935 added annual field conferences in 24 districts. A voluntary licensing program was recommended to the state health department and several examinations held, but little interest was taken in them. It is now proposed to erect "Approved Water Supply" signs on the main highways conditioned on the city's employing a qualified superintendent in charge of the water system and treatment plant.[A31]

Ground Water In West Virginia

The alluvial water-bearing strata along the Ohio valley in West Virginia furnish large supplies of water, which is cooler and more palatable than the river water. The water replacing that drawn from the sand and gravel strata is derived by percolation of local precipitation and infiltration of water from the river. If river water does not replace part of that withdrawn through wells, the yield is limited to the amount obtained from local precipitation, and the wells should be scattered widely. Where river water enters the aquifer, the perennial yields of wells may be substantially greater.[A33]

Bibliography of Waterworks Literature

The articles in each magazine are numbered continuously throughout the year, beginning with our January issue.

c. Indicates construction article; *n*, note or short articles; *p*, paper before a society (complete or abstract); *t*, technical article.

When you need special information—consult the classified **READER'S SERVICE DEPT.**, *pages 71-73*

A *Journal, American Water Works Ass'n*
February

26. Arkansas Plan for Licensing Water Works Operators. By W. R. Spencer. Pp. 127-128.
27. History and Purpose of the Certification Program in California. By K. W. Brown. Pp. 129-131.
28. Why License Waterworks Operators in Indiana? By P. S. Sikes. Pp. 132-134.
29. Licensing Water and Sewage Plant Operators in Indiana. By Ralph B. Wiley. Pp. 135-136.
30. Certification Program in Louisiana. By John H. O'Neill. Pp. 137-138.
31. Licensing and Training Water Plant Operators in Oklahoma. By Henry J. Darcey. Pp. 139-140.
32. Licensing Water and Sewerage Works Operators in Texas. By C. H. Billings. Pp. 141-143.
33. Recharge of Water-Bearing Formations Along the Ohio Valley. By Russell M. Jeffords. Pp. 144-154.
34. Ground Water Problems in North Carolina. By M. J. Mundorff. Pp. 155-160.
35. Ground Water Investigations in Pennsylvania. By George H. Ashley and Jack B. Graham. Pp. 161-164.
36. The Potentials of Ground Water Supplies of the Southwest. By Robert H. Dott. Pp. 165-169.
37. Surface Water Resources of the Southwest. By Trigg Twichell. Pp. 170-180.
38. Present Day Scope of Pitometer Surveys. By E. Shaw Cole. Pp. 181-188.
39. Uprating Distribution Systems by Cleaning and Cement Lining. By J. A. Frank. Pp. 189-198.
40. Getting Designed Capacity from Distribution Systems by Cleaning and Lining. Pp. 199-203.
41. A Photometric Method for the Determination of Nitrates in Water. By H. H. Wittenberg and G. K. Crowell. Pp. 204-206.
42. A Photometric Method for the Determination of Lead in Water. By A. V. A. Munton, H. H. Wittenberg and G. K. Crowell. Pp. 207-208.
43. Water Treatment at the Institute, W. Va., Synthetic Rubber Plant. By E. Leonard Borg. Pp. 209-213.
44. Hydraulic Bookkeeping by the Bernoulli Method. By Louis Mitchell. Pp. 214-223.
45. A Study of the Suitability of Chemical Warfare Service Activated Carbon for Use in Treatment of Public Water Supplies. By E. H. Mann and C. C. Ruchhoft. Pp. 238-244.

D *The Surveyor*
January 12

3. p. The Hollowell Reservoir Scheme for Northampton. By A. G. McLellan. Pp. 19-20.
4. p. The Evolution of the Waterworks Booster Plant. By J. P. Hallam. Pp. 23-24.

F *Water Works Engineering*
January 24

11. Flood Following Ice Jam Inundates Water Plant. By I. M. Glace. Pp. 80-81.

February 7

12. Philadelphia Underground Waste Surveys Pay Dividends. By Martin J. McLaughlin. Pp. 128-130.
13. Corrosion by Water Explained From the Operator's Viewpoint. By A. C. Janzig. Pp. 136-137, 158.
14. p. Chlorine vs. Chloramines in Destroying Bacteria. By Elsie Wattie and C. T. Butterfield. Pp. 140, 160.
15. Water Supply Development in the Soviet Union. Pp. 143-144.

G *Water Works and Sewerage*
January

5. Developments of the Year in Water Supply. By Samuel F. Newkirk, Jr. Pp. 1-10.
6. Cathodic Protection of Steel Surfaces in Contact With Water. By Lee P. Sudrabin. Pp. 11-16.
7. Buffalo Water Department Has Postwar Plans. By Alan D. Drake and Newell L. Nussbaumer. Pp. 25-27.

J *American City*
February

4. Meeting Unusual Water Supply Problems. By Wyatt B. Hendrick. Pp. 74-75, 99.
5. Houston Gets Needed Water. By J. M. Nagle. P. 77.

K *Proceedings, American Society of Civil Engineers*
January

1. Deterioration of Concrete Dams Due to Alkali-Aggregate Reaction. By R. F. Blanks and H. S. Meissner. Pp. 3-18.
2. The Effect of Blankets on Seepage Through Pervious Foundations. By Preston T. Bennett. Pp. 19-32.
3. Utilization of Groundwater Storage in Stream System Development. By Harold Conkling. Pp. 33-62.

L *Civil Engineering*
February

2. Resources of Water and Power Await Development in Puerto Rico. By Donald F. Griffin. Pp. 79-82.

M *Water and Sewage*
January

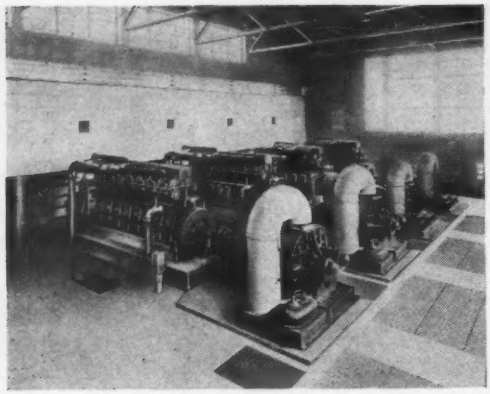
2. Water Demands and Sewage Flows at R. C. A. F. Airports. By J. C. D. Taylor. Pp. 17-20.

P *Public Works*
February

7. How Provo Traded River Water for Spring Water. By Guy R. McKay. Pp. 13-15, 28.
8. Deep Well Water Supply of Jamaica, N. Y. By Peter Ley. Pp. 21-22.
9. n. Bimonthly Billing by Pasadena's Water Department. P. 22.
10. c. Refacing a Concrete Dam. By Kenneth Terry. P. 32.
11. Providing Pure Water for the Army. Pp. 42, 48.

Z *Journal, Missouri Water and Sewerage Conference*
October

1. Rapid Sand Filtration Plant Mechanics and Terms. By Geo. S. Russell. Pp. 36-41.
2. Flood Experiences. By C. E. Schanze. Pp. 42-44.
3. Sealing and Acidizing of Wells. By Fred Whitten. Pp. 45-48.
4. Sedimentation Basin Design. Pp. 49-52.
5. Breakpoint Chlorination. By A. E. Griffin. Pp. 53-58.
6. Mechanical Aeration. By J. R. Sperry and J. D. Walker. Pp. 62-67.



Four gas engines direct connected to blowers, New York City's Tallmans Island plant.

The Sewerage Digest

Abstracts of the main features of all important articles dealing with sewerage and sewage treatment that appeared in the previous month's periodicals.

Daphnia Magna For Determining Toxicity

Several investigators have used the microcrustacean *Daphnia magna* as a test animal for the biological assay of many materials, including the detection of toxic materials in trade wastes. They do not exceed 5mm in length, so a great many can be reared in a small space. Their maximum life span is about 2 months at 25° C. They are easy to culture, either individually or in mass cultures. They give rise to a new brood every two or three days, with an average of 20 to a brood. The authors give various factors to be considered when they are employed for detecting materials in trade wastes, and a method for using them is described in detail, with threshold concentrations for 42 substances when added to Lake Erie water.[C6*]

Corrosion by Hydrogen Sulphide

"Once septic conditions have established themselves in a sewerage system, the time required for the oncoming sewage to become septic is greatly reduced. . . . The only explanation is that the continuous contact of the sewage along its whole length of travel with foul silt and probably slimy deposits on the walls of the collector, combined with the warm temperatures prevailing (19°-30° C.), brings about a much more rapid decomposition than would normally be the case." (This refers to sewers in Egypt.) Investigation showed that sulphide is produced more rapidly at 30° than at 21° C., but the rate does not increase materially above 30°; little sulphide is produced at 7° C. Therefore, any factor tending to delay sewage in its travel or increase its temperature will be a factor toward septicity and potential corrosion of concrete structures. This is an argument against long outlet sewers and distant location of treatment plants. Under many conditions chlorine is the most obvious, useful, simplest and cheapest method of preventing trouble. The author favors, for large outfall sewers, lining them with acid-proof brick jointed with a high-silica acid-proof mortar.[D6*]

*See Bibliography in the February issue.

Final Tanks For Activated Sludge

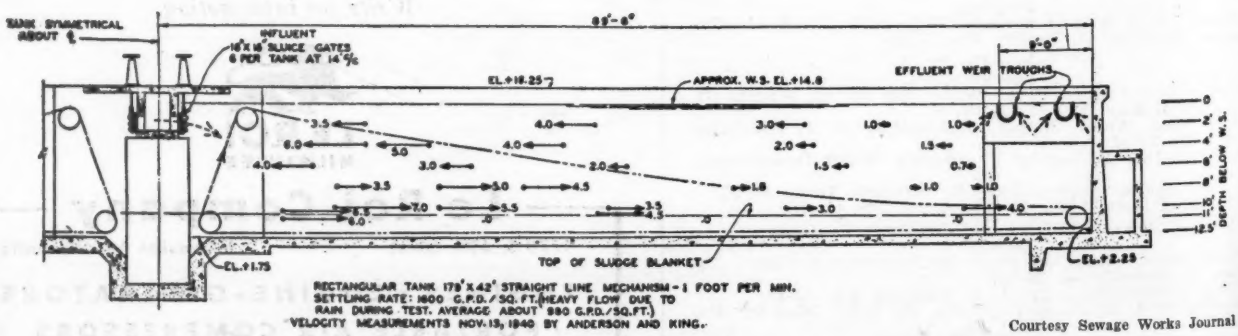
Mixed liquor from the aeration tanks of the activated sludge process, when introduced into a settling tank, produce "density currents," because it is such an intimate suspension of flocculent solids that it acts as a liquid of greater density than water. These currents are not present in other sewage settling tanks. The mixed liquor influent plunges to the bottom of the tank and flows along the bottom until deflected upward by some obstruction, usually the wall of the tank, thereby inducing a counter current in the upper levels back toward the influent.

Depth of tank is important. The author thinks that, for circular tanks with center inlet, the radius should not exceed about 5 times the side water depth, and for rectangular tanks the flow length should not exceed about 7 times the depth. The depth below the effluent weirs should not be less than about 10 ft. in order to avoid any disturbance caused by the mechanism and density current, nor less than 12 ft. if the weirs are located at the upturn of the density current.

No type of baffle has much effect on the quality of the effluent. The mixed liquor should be introduced as gently, or at as low a velocity as possible, without depending on baffles. But a baffle extending above the water surface and about 3 ft. below it for submerging light solids is beneficial.

If effluent weirs are located away from the upturn of the density current, the overflow rate should not exceed 20,000 gpd per ft. of weir, nor exceed 15,000 gpd if located within the upturn zone. In circular tanks, effluent weir troughs may be carried on cantilever brackets from the wall and thus removed from the upturn zone. In a 77 ft. square tank the troughs can be placed within 7 ft. of the influent end, but less than this gave poor results.

In drawing off sludge, the two desired results are quick removal to keep the return sludge as fresh as possible, and as much concentration as possible. Both are aided by mechanical sludge removers. Probably only the



Courtesy Sewage Works Journal

Final settling tank at Wards Island, New York City; showing counter currents in the upper levels

heaviest particles are actually conveyed by these, their chief function being to prevent adherence of the sludge to the bottom.[C27]

Operating Staffs For Sewage Plants

The operating staffs necessary for properly operating a plant vary with character as well as size of the plant. Comparing several plants, each for 20,000 population, one on the coast or a large river might require only primary treatment and a staff comprising a superintendent or chief operator, an operator skilled in mechanical and electrical maintenance, and two general operators. A plant on a small stream might require trickling filters and final sedimentation, and the staff should include an operator skilled in chemistry and a laborer in addition to the above. Or the treatment might substitute vacuum filters for drying beds, the same operating staff being called for. That staff would suffice also if the sludge cake is dried and burned, except that, if operated for more than one shift, an additional man would be required for each shift. An activated sludge plant should contain a superintendent, a chemist, an operator skilled in electrical and mechanical maintenance, four general operators and a laborer; with two additional men if an incinerator were operated on a 24-hour basis.[C22]

Safety in Gas Utilization

This comprehensive paper deals with ventilation, chimneys, boilers, gas piping, gas meters, condensate traps, pressure regulators, combination pressure and waste gas reliefs, flame traps, flame cells, low-pressure check valves, pressure gauges, waste gas burners, explosion reliefs, mixed gas utilization, gas holders, pressure-vacuum reliefs, lightning hazards, digestion tanks, gas control room, boiler room, sludge pumping facilities, electrical systems, control chambers, pipe tunnels, and air pollution abatement. It is emphasized that primary reliance should be placed on the *fundamentals* of safe practice. "No smoking" signs are all right, but they should not be necessary.[C28]

Films in Biofilters and Standard Filters

Comparative studies of biofilters and standard filters led to the following conclusions:

Except during the maturing period, the variations in quantity of film in the biofilter follow directly the load applied to the filter expressed as pounds of B.O.D. and suspended solids. In both filters the quantity of film was high in winter and low in summer. In both, the vertical distribution of film was uniform in summer, but in winter the maximum quantity in the biofilter was found below the top level whereas in the standard filter it was found at the top; this difference being attributed to incomplete adsorption and removal of the load by the biofilter at the surface because of inadequate contact time. Within a range of flow from 7 to 18 mgad (which includes recirculation) there did not appear to be, in the biofilter, a flushing action effective in dislodging the film.

The quantity of film in the standard filter was 8-12 lb. per cu. yd. of stone; in the biofilter, 5.5-11 lb. The important factors determining the quantity of film in the biofilter are: (a) B.O.D. and suspended solids applied and removed. (b) Higher temperatures increase the removals, but the net effect, on the basis of equal loadings,

When you need special information—consult the classified READER'S SERVICE DEPT., *pages 71-73*

is to decrease the quantity of film because of a higher rate of biological oxidation of the film. (c) Unloading in the biofilter is continuous and not seasonal and does not deplete the quantity of film markedly. Increase of suspended solids in the filter appears to be due to failure of the bed to remove them rather than to unloading. The numbers of insect larvae in the biofilter are lower than in the standard and do not increase in summer, and larvae probably play a restricted role in the biofilter.[C24]

Sludge Flotation In Sedimentation Tanks

Difficulty has been experienced in several English sewage treatment plants by the rising of sludge in primary sedimentation tanks which received waste water containing ammonium nitrate from shell-filling factories. Sludge flotation occurred also in the sedimentation tanks at a water treatment plant at an explosives factory, where the raw water was contaminated with waste water from the factory which contained nitric acid. Small-scale and large-scale experiments indicated that rising of the sludge was due to liberation of gaseous nitrogen as the result of bacterial decomposition of nitrate. It was found that liberation of gas could be prevented by the addition of a large concentration of a substance that inhibits bacterial activity, such as sufficient bleaching powder to give 20 ppm of available chlorine; but was not prevented by 5 ppm of chlorine, 1 ppm of copper sulphate, 10 ppm of lime, or 10 ppm of activated carbon.[D7]

Sanitary Engineering In Pan America

Requests for sanitary engineering services and advice from the Pan American Sanitary Bureau have so increased that the Bureau has increased its engineering personnel from two to eight, six of which and an entomologist are operating in Central America. In connection with the Pan American highway project, surveys have been made embracing sanitary evaluations of water supplies, means of sewage disposal, milk supplies and handling, abattoirs, markets, malaria foci, etc. The Bureau has aided in establishing a plant for manufacturing liquid chlorine in Peru. Among several items to receive future consideration is the developing of standard specifications for materials and equipment in the chemical and mechanical fields.[N1]

Determining Grease in Sewage

Since the publication in *Standard Methods* in 1936 of the method of determining grease recommended by the Federation of Sewage Works Associations, several new methods have been proposed. A committee reporting to the New York State Sewage Works Ass'n in 1944 considered 5 of these, as proposed by Gehm in 1941, by Hurwitz & Ludwig, Pomeroy and Wakeman, Eliassen and Schulhoff, and another proposed by Gehm in 1943. The last two were suggested after the committee began its investigation, and were not included in comparative studies conducted by three laboratories. The committee considered Gehm's oil extraction method to be more in the nature of an approximate and rapid test than one which could be chosen as a standard method; personnel time and elapsed time for the determination are important factors, as is equipment; the long time of the coagulation and filter aid treatment method of Gehm rules against this method, while the newer method of lime coagulation of Eliassen and Schulhoff has distinct advantages as to both time and equipment required, but it unfortunately lacked confirmation in other laboratories.

The committee defines grease as "that material which is extracted from an acidified sample of sewage by petroleum ether (b.p. 40-60° C) when using the standard procedure as outlined by the committee." This standard procedure "consists of the refrigeration method combined

with a wet extraction of the filtrate to remove any emulsified grease which may not be removed by the chilling and filtration process." The committee agreed that this method best fitted the needs of the field as regards equipment, personnel time involved, elapsed time, and simplicity of technique.[C23]

Index for Sedimentation Efficiency

The effective use of percentage removal as a criterion for establishing a standard which a plant should meet if functioning properly depends upon a reasonable correlation between such percentage and the ppm remaining in the effluent. Such correlation does not exist in plants where there is considerable variation in sewage strength and flow. The author gives data from one plant where the effluent ppm of suspended solids actually increased as the percent removal increased because of great variation in the suspended solids content of the influent. He proposes a "sedimentation index" obtained by adding the percentage solids remaining in the effluent to the ppm of solids also remaining in the effluent. Standards would have to be worked out independently for each locality, with perhaps some sort of limiting standard for an entire region or drainage area.[C21]

Bibliography of Sewerage Literature

The articles in each magazine are numbered continuously throughout the year, beginning with our January issue.

c. Indicates construction article; *n*, note or short article; *p*, paper before a society (complete or abstract); *t*, technical article.

C *Sewage Works Journal*
January

21. A Modified Index for Sedimentation Efficiency. By Joseph Doman. Pp. 3-9.
22. Operating Staffs for Sewage Treatment Plants. By N. S. Holroyd. Pp. 10-15.
23. The Determination of Grease in Sewage. By W. D. Hatfield and George E. Symons. Pp. 16-22.
24. The Relationship Between Accumulation, Biochemical and Biological Characteristics of Film, and Purification Capacity of a Biofilter and a Standard Filter. By H. Heukelekian. Pp. 23-38.
25. Industrial Coffee Wastes in El Salvador. By Paul C. Ward. Pp. 39-45.
26. Preaeration, Grit Chambers and Skimming Tanks. By Frank S. Currie. Pp. 46-49.
27. Design of Final Settling Tanks for Activated Sludge. By Norval E. Anderson. Pp. 50-65.
28. Safety Considerations in the Design of Gas Utilization Facilities. By Leonard L. Langford. Pp. 66-88.
29. Proposed Improvements in Sewage Disposal and Treatment in the Boston Metropolitan District. By Karl R. Kennison. Pp. 89-98.
30. Summary of Experience in Mechanical Activated Sludge Plant Operation. By Douglas E. Dreier. Pp. 101-126.
31. Operation of a Mechanical Aeration Activated Sludge Plant. By William D. Denise. Pp. 127-129.
32. Extracts from Operation Reports. By LeRoy W. Van Kleeck. Pp. 130-140.

D *The Surveyor*
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6. *p.* Effect of Nitrates on the Rising of Sludge in Sedimentation Tanks. By T. W. Brandon and J. Grindley. Pp. 7-8.

January 26

7. *p.* Operation of an Enclosed Aerated Filter at Dalmarnock Sewage Works. By Alexander Hunter and T. Cockburn. Pp. 51-53.

G *Water Works and Sewerage*
January

2. Determination of Suspended Solids in Aeration Tank Liquor. By A. A. Hirsch. P. 28.
3. Operating Digesters at Higher Temperature and Eliminating Supernatant. By Van K. Tharp. Pp. 29-30.
4. Problems in Handling Sewage Sludge. By Charles R. Velzy. Pp. 31-35.

M *Water and Sewage*
January

6. Hazards in the Operation of Sewage Works. Pp. 21-24, 48.
7. Postwar Sewage Works Design. By John Hurley. Pp. 27-28, 42.

N *Boletin De La Oficina Sanitaria Panamericana*
October

1. Application of Antilarval Siphons in Argentina Republic. By Carlos Alberto Alvarado and Luis Silvetti Pena. Pp. 876-886.
2. Report of the Pan American Committee on Sanitary Engineering. By Abel Wolman. Pp. 890-894.

P *Public Works*
February

7. Modernization of the Sewage Treatment Plant at Detroit Lakes, Minn. By Winston C. Larson. Pp. 19-20.
8. Vacuum Filtration at the Minneapolis-St. Paul Plant. Pp. 26, 51.
9. Units for Expressing Loadings on Filters. P. 34.

Keeping Up With New Equipment

Allis-Chalmers Mower

All Purpose Mower Announced by Allis-Chalmers Manufacturing Co.

Tractor Division
Milwaukee 1, Wis.

A new heavy duty, general purpose mower for highway, park, golf course, airport or miscellaneous service has been announced by Allis-Chalmers Manufacturing Company, Milwaukee, Wisconsin. Mounted as a unit on a Model "B" Allis-Chalmers tractor, the mower has a variety of travel speeds for all conditions, and possesses unusual stability for operations on extreme slopes and difficult angles.

A five foot heavy duty cutter bar is within full view of the operator and is smoothly and easily raised and lowered by a power hydraulic lift. The inner shoe is located outside the rear wheels and can be raised a distance of twelve inches by a conveniently located hand lever. The sickle delivers a full cutting stroke through a wide range of positions from 45° below horizontal to 60° above tailoring it for highway mowing, cutting slopes and banks, hedges and shoulders. To insure protection for the sickle when obstructions are accidentally encountered, the belt drive slippage provides a safety relief and eliminates any possible damage. The mower design leaves the drawbar open enabling the tractor to pull gang-mowers or other equipment without removing the cutter bar.

To obtain complete specifications on this new Model "B" General Purpose Mower, write to the Tractor Division, Allis-Chalmers, at Milwaukee 1, Wisconsin.

Worthington Making a Dual Fuel Engine

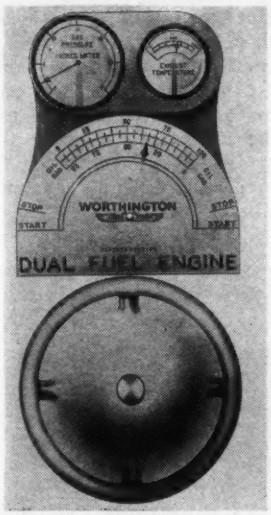
Worthington Pump and Mach. Corp.
Harrison, N. J.

An engine capable of instantaneous conversion from oil to gas fuel without change in load or speed has gone into production at the Buffalo Works of the Worthington Pump and Machinery Corporation. Conversion from one fuel to the other or adjustment of a combination of both is accomplished by one revolution of a single control wheel. Tests and public demonstrations prove the new product highly successful; the first installation is already operating in a large municipal plant.

The need for an internal combustion engine capable of operating either on gas or oil fuel or quantities of both has long been apparent.

The Worthington dual fuel engine meets these requirements as it burns either gas or oil or both together. Regardless of the fuel being used, the engine operates on the highly efficient Diesel cycle, thus realizing fuel economies heretofore unobtainable in gas engine operation.

The Worthington unit does not require a high pressure fuel gas supply to the engine. A pressure of two inches of water is used.



When operating a gas engine, pilot oil ignition is used, eliminating electric ignition. Pilot fuel can be used in amounts as low as 5% of the total full load Btu requirements of the engine.

Fuel consumption as a gas engine is appreciably less than that of a similar engine operating on the conventional spark ignition Otto cycle.

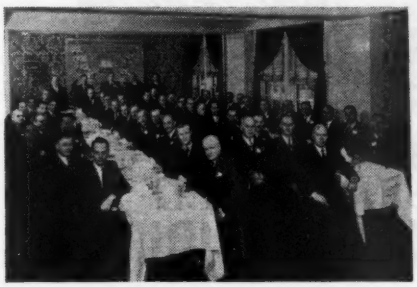
This system is produced by Worthington to cover the entire range of its Diesel sizes. The units retain all of the distinctive features of Worthington design and construction.

Although the flexibility of this new system makes it applicable to many fields, it is most ideally suited for use in sewage plants, municipal plants, and gas utilities. Worthington engineers have already prepared complete information covering these applications.

Le Roi Company A.E.D. Distributor Breakfast

In conjunction with the 26th Annual Associated Equipment Distributors' Convention held in Chicago, January 21-24, Le Roi Co., Milwaukee, Wis., gave a distributors' breakfast.

This breakfast was held at the Edgewater Beach Hotel, Chicago (convention headquarters) and was attended by members of the Le Roi distributor organization. The meeting was primarily held for the purpose of outlining to their distributors their extensive postwar plans. The company officials revealed the addition of several new compressor models to round out a complete line of units of gasoline and diesel-powered compressors which will be available in sizes from 60 to 500 c.f.m. A review was also made of Le Roi's outstanding record of achievement in supplying many thousands of Le Roi portable air compressor units to the U. S. Army and Navy as well as to our Allies.



Le Roi Co. Distributor Breakfast

The equipment requirements of the contemplated postwar construction program offers a challenge to the manufacturers of portable air compressors.

Sterling Engine Gets 4th Army-Navy "E" Flag

For the fourth time the Sterling Engine Co., Buffalo, manufacturer of gasoline and diesel engines, has raised a new Army-Navy "E" flag over its plant, this time with the third star affixed, signalizing a continuance of high production standards for war.

Announcement of this latest honor was made in a congratulatory letter by Admiral C. C. Block, U.S.N. (Ret), to Addison F. Vars, President of the Sterling Company. The first award was made in April 1943 and has been repeated at regular intervals.

Among the Sterling engines that power many types of craft for the Army, Navy, Coast Guard and Allied Nations are Sterling Admirals, Vikings

and Petrels in power range from 85 HP to 1800 HP.

The Sterling Company has been building engines for nearly half a century for both marine and stationary power applications. Out of these years of experience, just recently announced, has come the new Viking Diesel Engines, six and eight cylinders, supercharged and unsupercharged to meet the horsepower requirements of a wide range of power needs.

Cooper-Bessemer Announces a New Gas Engine

Cooper-Bessemer Corp.
Mt. Vernon, Ohio

Ralph L. Boyer, chief engineer for Cooper-Bessemer Corp., says the new engine will enable operators to use either gas or oil as fuel without any electrical sparking device, and will cut fuel consumption of gas engines by from 20 to 25 percent.

And states that the new engine is the result of experimentation which began in 1928. Recently efforts have been rewarded by the successful operation of a natural gas engine on the Diesel principle. This enables the unit to operate on a wide variety of fuels including fuel oil, natural gas, manufactured and coke oven gases, sewage gas, and refinery by-products.

The conversion from liquid to gas fuel is as simple as the closing of one valve and the opening of another with the engine operating continuously at full load, Mr. Boyer said.

The new principle will enable the engine to have the same fuel economy regardless of the type of fuel used. It raises the normal 25 percent thermo-efficiency of the gas engine to the 35 percent thermo-efficiency common in Diesel oil engines.

When you need special information—consult the classified READER'S SERVICE DEPT., *pages 71-73*

Ludwig Arnson, Pres., Radio Receptor, Inc.; Comm. Corydon M. Wassell, Lt. D. K. Porteous, Hugo Cohn, Vice-Pres., Radio Receptor Co.

Dr. Wassell Guest As Radio Receptor Receives Second White Star Award

For the third time, the men and women workers of Radio Receptor Co., Inc., have been honored by the Army and Navy of the United States. In a ceremony at the company's plant, Lt. Douglas K. Porteous, on behalf of the military services, awarded the second White Star to the personnel for high performance on the production line. An interested guest, who dropped in by coincidence, was Commander Corydon M. Wassell, U.S.N.R., known familiarly to millions of Americans as Dr. Wassell.

New Littleford Folders

Littleford Brothers, Inc.
452 E. Pearl St., Cincinnati 2, Ohio

Bulletin No. U-5 describes Model No. 101 Utility Sprayer Tank, developed to meet the demand for a utility road and airport runway construction and maintenance unit combining a variety of uses to cut costs: Four-wheel Trailer Type Sprayers—600 to 1,200 gallons; Truck Mounted Type, Emulsion Sprayers; Cut Back Sprayers and small sprayers for patching.

Bulletin U-14 describes "Spray Master" pressure distributors, the efficient spraying units for cities, counties and contractors. They are claimed to heat faster, operate easier, with fewer controls and fewer valves.

Bulletin U-19 describes Model 108 two-way engine driven road brooms which sweep right or left and Model 106 two-way traction driven road brooms.

Bulletin U-25 describes supply tanks for handling hot or cold bituminous materials. They are made in two types —with kerosene vaporizing burners and fuel oil air atomizing low pressure burners.

Write Littleford Bros. for copies of these bulletins.

O. G. Mandt

O. G. Mandt Now President of Jaeger Machine Co.

O. G. Mandt, for the past 17 years vice president and general manager of The Jaeger Machine Company, Columbus, Ohio, was made president of that organization February 3. Gebhard Jaeger, former president, was elected chairman of the board and R. McLean named vice president, in charge of sales. Entering the construction industry in 1906 as a manufacturer of tilting concrete mixer, The Jaeger Machine Company has expanded to become one of the largest manufacturers of contractors pumps, various types of mixers, truck mixers and road spreading and finishing machines. During the war it has engaged in the large scale production of invasion ship winches, air compressors, and material loaders and cranes for war needs. These latter lines, which were introduced to over 700 of Jaeger's distributors, highway officials and contractors at an exhibit held in the company's plant in January, will be continued for civilian use after the war.

Harold S. Hutton Honored on 25th Anniversary

Harold S. Hutton, Sales Manager of Wallace & Tiernan Company, Inc., Newark, New Jersey, was honored by his associates at a dinner on February 8th at the Montclair Golf Club, Montclair, New Jersey, on completion of twenty-five years with the Company.

Mr. Hutton graduated from Columbia University in 1916 with the degree of Civil Engineer. He was an officer in the U. S. Public Health Service and served as a First Lieutenant in the Engineer Corps in World War I. Following his discharge from the Army, he joined Wallace & Tiernan Company on February 9, 1920. He was subsequently appointed District and Division Manager with headquarters in Pittsburgh where he was located for a number of years prior to coming to Newark upon his appointment as Sales Manager.

He is a member of the American Society of Civil Engineers, American Public Health Association and American Water Works Association; also of the Delta Tau Delta, Tau Beta Pi, Sigma Xi. His Clubs include Montclair Golf Club and Columbia University Club.

The dinner for Mr. Hutton was sponsored by the W&T Diamond Club, com-

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Van Devanter Engr. Co. to Represent Yeomans

Association of the Van Devanter Engineering Co. of St. Louis as sales representatives is announced by Yeomans Brothers Company, Chicago, manufacturer of pumps, compressors and sewage treatment equipment. The St. Louis firm will handle sales and service to municipalities in eastern Missouri and southern Illinois. This supplements Yeomans representation in this area since the H. L. Grossman Co., also of St. Louis, will continue in the building and industrial fields in much of the same territory.

M. S. Van Devanter, founder of the firm, offers to municipalities in this area a well-rounded experience in sanitary engineering. He is also president of Russell and Co., Inc. which specializes in erecting, maintaining and operating sewage treatment plants and other sanitary facilities for municipalities. In this connection he maintains one of the best equipped laboratories for biological analysis, enabling him to keep a check on purification results being secured from treatment plants under his supervision.

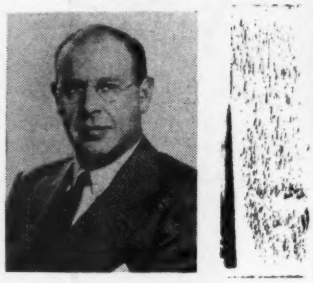
Hal G. Sours Becomes a Business Man

Hal G. Sours, former state highway director, and Eugene E. Baldwin, of Taylor & Baldwin, Columbus, Ohio, have formed a partnership to handle highway materials and equipment. The firm is "Baldwin & Sours," with offices at 83 South High Street, Columbus, Ohio.

The principal products which they have to distribute are asphalt, road oil, chemicals for ice control, bituminous distributors and accessories, street sweepers, salt and stone spreaders and truck scrapers. Several additional products will be added during the next few months.

Sours has been in State and County highway work for the past twenty-four years. He served three terms as county engineer of Summit county and was with the state highway department in northern Ohio for several years. The past six years he has been in the Columbus office, first as the Chief Engineer and then Director of the State Highway

Department. For many years active in highway association activities, he was President of the American Road Builders' Association two years and more recently Vice President of the American Association of State Highway Officials.



Charles W. Springer

Graver Tank & Mfg. Co. appoints New Eastern Sales Manager

Announcement has been made of the appointment of Mr. Chas W. Springer as Manager of Eastern Sales by the Graver Tank & Mfg. Co., Inc., of East Chicago, Indiana.

Mr. Springer—formerly Sales Manager, Barrel Division, Jones and Laughlin Steel Company and familiar to many as a representative of the Chicago Bridge and Iron Co. — brings to the Graver organization a well rounded background of executive sales direction in the steel plate and allied fields.

Mr. Springer will direct all of Graver's east coast sales activities from the company's offices at 424 Madison Ave., (17), New York City.

Death of Charles D. Snead Division Engineer, Public Roads Administration

Mr. Snead, Division Engineer of the Public Roads Administration, Federal Works Agency, died on February 13, after an illness of several months. For some years he had directed Federal highway activity in Alabama, Georgia, Florida, Mississippi and Tennessee with headquarters at Montgomery, Alabama.

He was a native of Virginia, attended high school in Lynchburg and graduated in engineering at Virginia Polytechnic Institute in 1906.